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SLEEPING SICKNESS.

LEAGUE OF NATIONS. **Final Report of the League of Nations International Commission on Human Trypanosomiasis.**—392 pp. With 131 figs., 2 coloured plates & 5 maps. 1928. Geneva: Publications of the League of Nations (III. Health. 1927. III. 13. C.H. 629).

The final report of the International Sleeping Sickness Commission is a formidable document consisting of 392 pages. It is divided into seven sections :—

I. **Report of the New Sleeping Sickness Focus at Ikoma.** By F. K. KLEINE. [pp. 7–20. With 2 figs.]

At Ikoma, Tanganyika Territory, 56 cases of human trypanosomiasis were seen; the parasite was *T. rhodesiense* and the insect carrier *G. swynnertoni*. Kleine states that the cases were without doubt clinically distinct from those he had previously observed. In the majority of the patients the disease in a few months caused complete physical collapse before any definite enlargement of the glands occurred, or infection of the central nervous system became clinically apparent. Trypanosomes were usually numerous in the peripheral blood. The morphological characters of twelve strains were studied in guineapigs inoculated directly from the patients. The percentage of posterior nuclear forms found varied from 0 to 20, and all degrees of transition between the individual strains were observed. The human strains examined at Ikoma were considerably more virulent than those on the Kavirondo Coast.

The conclusions are :—

"1. The two trypanosomes of man, *T. gambiense* and *rhodesiense*, are probably identical.

"2. The various fresh outbreaks of the epidemic in Tanganyika Territory are probably to be traced to immigration of sick natives from the old sleeping-sickness foci on Victoria Nyanza and Lake Tanganyika.

"3. The results of sleeping-sickness therapy will improve in so far as the infected natives can be kept under permanent medical control."

II. **Studies on the Bionomics of the Polymorphic Trypanosomes of Man and Ruminants.** By H. L. DUKE. [pp. 21–116. With 1 map & 5 figs. (36 refs.).]

In his introductory remarks Duke states that he has endeavoured to throw light on two of the questions in the original terms of reference

(K 3519) Wt P18/261 1.625 10/28 H & Sp Gp 52 52

of the Commission, viz.: the relationship between Trypanosomiasis gambiense and Trypanosomiasis rhodesiense, and the rôle of ruminants in the spread of human trypanosomes. He wishes it to be understood that his studies, if not actually premature in their appearance, are incomplete. The conclusions are provisional and mainly useful in determining the trend of further investigations.

Stress is laid on confusion which has resulted from the fact that so much importance has been laid on the study of ancient laboratory strains maintained for years in laboratory animals, and on the desirability of limiting observations and deductions to strains transmitted from ruminant to ruminant by cyclical passage through tsetse. Such strains have now been under observation for more than a year at Entebbe, and it is hoped that they will be continued for years; these strains—both *gambiense* and *rhodesiense*—have been collected from the widely different sources indicated in a map, and with one exception—a *rhodesiense* strain—have been obtained from untreated human beings. As *T. gambiense* offered greater facilities for study it was decided to concentrate first on this parasite. The experimental work is set forth in considerable detail as even seemingly irrelevant information may later prove to be of great importance.

Duke states that it is already known that certain strains of trypanosomes are not cyclically transmissible by tsetse, and in support of this he quotes ROUBAUD (1910), KLEINE (1914) and REICHENOW (1921). This inability to pass cyclically through tsetse may be complete or it may extend only to the final and all-essential invasion of the salivary glands. Some strains are very much more readily transmissible than others, and it is important to recognize these differences in comparing different strains.

In this work a new method has been adopted to indicate the degree of transmissibility or "la contagiosité" of a strain of trypanosomes. For reasons discussed the percentage of infected flies in any experiment, or series of experiments, gives no reliable information about the transmissibility of the strains by tsetse. In order to discover this certain information is essential and when this has been obtained the transmissibility can be expressed by means of the following formula :—

$$T = \frac{s}{p} \times \frac{n \times 100}{N}$$

Where T=transmissibility index; N=total number of flies dissected; n=total number of flagellate-containing flies; p=number of flies of 25 days old or over; and s=the number of these mature infected flies which shows gland invasion.

This transmissibility index is a valuable basis on which to compare different strains. Details are given of the technique used in the experiments.

The author then passes to a study of nineteen recently isolated strains of *T. gambiense* from nineteen different untreated African natives in *G. palpalis* areas. An account is given of the origin, upkeep at the laboratory, and the animal reactions of these strains; and an examination of their cyclical transmissibility by *G. palpalis*, when first isolated from man. This work is set forth in great detail. The data relating to the transmissibility index is summarized [by the reviewer] in the following table :—

SUMMARY OF EXPERIMENTS UPON THE TRANSMISSIBILITY INDEX OF NINETEEN STRAINS OF *T. gambiense*.

Strn	Animal or Patient.	Date.	Total flies dissected.	Total infected flies.	Percentage of infected flies.	Number of infected flies alive on 25th day.		Percentage of gland infections.	Trans-missibility Index.
						With glands infected.	Total.		
1	Monkey 52	Mar. 8 Apr. 1926	216	6	2·7	1	3	0·9	0·9
2	Monkey 53	Mar. 1926	199	7	3·5	0	5	0	0
3	Monkey 90	May and June 1926	127	1	0·7	0	1	0	0
4	Blasio	Mar. 1926	155	5	3·8	5	5	1·9	2·2
5	Monkey 64	Apr. May 1926	154	8	5·0	7	7	4·5	5·0
6	Monkey 65	May 1926	150	4	2·6	0*	4	0	0
7	Tekisoka	June 1926	180	13	7·2	6	11	3·3	3·9
8	Zakayo	June 1926	183	3	1·6	0	3	0	0
9	Mangasi	July 1926	158	16	10·1	11	14	6·9	7·9
10	Monkey 149 ...	Aug. 1926	158	4	2·5	1	4	0·6	0·6
11	Monkey 162 ...	Aug. 1926	218	16	7·3	5	11	2·2	3·3
12	Acholi	Dec. 1926	157	3	1·9	1	1	0·6	1·9
13	Boki	Dec. 1926	139	3	2·1	3	3	1·1	2·1
14	Falajala	Dec. 1926 Jan. 1927	135	7	5·1	4	6	2·9	3·4
15	Awasi	Dec. 1926	149	7	4·6	5	5	3·3	4·6
16	Kakowa	Feb. 1927	187	6	3·2	2	4	1·0	1·6
17	Duzungu Pio	May 1927	177	1	0·5	0	0	0	0
18	Mayani	May 1927	182	0	0	0	0	0	0
19	Labilo	Sept. and Oct. 1926	175	0	0	0	0	0	0

[* The figure given in the Report is 3, but this is apparently an error.]

From these experiments the author draws the following conclusions:—

"It is clear from these experiments that, on their first isolation from man, or actually in man himself, different strains of *T. gambiense* show great differences in cyclical transmissibility by *G. palpalis*.

"Of the nineteen strains examined above, twelve were studied in the human patient. Of these twelve strains, four were non-transmissible cyclically by laboratory-bred *G. palpalis*, i.e., 33·3 per cent.

"The transmissibility of a strain seems to bear no constant relation to the virulence of that strain in man. Strains Nos. VII, IX and X all appeared to be virulent in their effects on the patient; their Transmissibility Indices were respectively 3·9, 7·9 and 0·6.

"As a rule, it is very difficult to determine the duration of an infection in a native. Consequently, it is very difficult to determine to what extent prolonged sojourn in man affects the transmissibility of a trypanosome. The condition of the cerebro-spinal fluid indicates the stage of the disease, but it does not tell us much about its duration; a virulent strain may produce big changes in a comparatively short time. The cell-counts of the cerebro-spinal fluid from five of the six patients who supplied the non-transmissible strains were as follows:—

Strain.	Per cubic mm.
III	2·5
VIII	11·5
XVII	415
XVIII	6
XIX	1610

and these figures teach us nothing definite. Taking now the cases showing the greatest alteration of the cerebro-spinal fluid:

Strain.	Cells per cubic mm.	Index.
XV	106	4·6
VII	208	3·9
XVII	415	0·0
IX	560	7·9
XII	1,030	1·9
XIX	1,610	0·0
II	1,900	1·2 (*cf.* Part II)
X	2,320	0·6

and again there is little to learn.

"Possibly there is a slight indication that a low degree of transmissibility is associated with a much-changed cerebro-spinal fluid, and this with an old-standing infection; but this is little more than speculation.

"More justifiable would seem the inference that, at any stage of an infection of man by *T. gambiense*, the transmissibility of the trypanosome by *G. palpalis* may be lost."

[The reviewer has some doubt whether anything of the nature of criticism is desirable in this *Bulletin*, and for that reason rarely ventures to express any opinion on the papers he summarizes. This article is, however, of more than usual importance, not only by reason of the subject dealt with, but also because it emanates from a member of an International Commission and therefore demands more than ordinary consideration. The reviewer has the greatest respect and admiration for careful work of this kind, and a very lively appreciation of the difficulties with which those who carry on such fundamental investigations have to contend. It is to be hoped, therefore, that the few remarks which follow will not be regarded as captious and carping criticism, but rather as suggestions which possibly may be helpful to the author, and to others who may be stimulated by his labours to undertake work of a similar nature.

If we return to the author's summary we see at once that the vital deduction is that contained in the secondary paragraph, viz., that

of the twelve strains studied in the human patient, four, i.e., 33·3 per cent., were non-transmissible cyclically by laboratory-bred *G. palpalis*. As the whole of the remainder of the argument is based on this conclusion, it is of importance to examine the observations, and consider whether we can satisfy our intelligences that they are of such a nature as to justify the conclusion reached by the author. It has long been recognized that, in striking contrast to what occurs when suitable anopheles are fed, under optimum conditions, on blood containing numerous malaria gametocytes, never more than a comparatively small percentage of tsetse, fed on a case of sleeping sickness, become infected and show invasion of their salivary glands with metacyclic trypanosomes. This fact, so it appears to the reviewer, must be kept prominently in mind when considering work of the kind Dr. Duke has undertaken. Why only a very small proportion of tsetse become infected or infective we do not know. So far alteration of the conditions of experiment has not succeeded in increasing the proportion to any material extent. Whatever be the cause the reviewer cannot avoid the conjecture that it lies in the flies themselves: some are susceptible to infection at the time they are fed and others apparently are not.

Let us now consider the data collected by Dr. Duke which the reviewer has summarized in the table given above. If we consider two extreme cases, we see, for example, that with Strain IX, 6·9 per cent. of the 158 flies fed were found to have salivary gland infections; and that with Strain VIII, none of the 183 flies fed developed salivary gland infections. From this Duke concludes that the former strain is readily transmissible and the latter non-transmissible. No one will doubt the figures or the careful manner in which they were obtained, but the question which troubles the reviewer is whether they will allow of the conclusion which Duke has reached. Are the figures large enough? Were sufficient flies used in each of these experiments having regard to the fact that under no known conditions of experiment do more than 5–8 per cent. ever become infective? If at the same time a whole series of batches of 158 flies had been fed on Strain IX would we always have obtained 6·9 per cent. of salivary gland infections, and never 1 per cent. or 0 per cent.; and similarly if a whole series of batches of 183 flies had been fed on Strain VIII would the result always have been 0 per cent. of infection, and never 1 per cent. or even 6·9 per cent.? What is the error which must be allowed for in comparing the results of observations based upon figures such as those furnished in the table? If we apply the ordinary tests, we find that the error is such that it is doubtful whether the figures have any comparative value.

This discussion must not be taken to mean that the reviewer considers the work in question as valueless—far from it—but that he does not feel able to accept Duke's conclusions from the data which he has so far accumulated. In the reviewer's opinion the matter must at present be regarded as non-proven. It is only fair to point out that Duke himself seems to have some doubts on the matter, for in Section V he writes—"It may be objected that the conclusions drawn in these papers are not warranted by the evidence, and that the number of flies is too small."]

The next portion of Duke's report relates to the behaviour of some of these strains in ruminants and the changes they undergo during a sojourn in animals other than man. It was not found possible to introduce all of the nineteen strains into ruminants, and some of them were much more carefully studied than others. The sheep and goats

used in the experiments came from a fly-free area, and were all carefully examined before use. There appears to be little difference in the susceptibility of sheep and goats to *T. gambiense.* Occasionally, these animals may resist infection with *T. gambiense* when bitten by infected flies. On two occasions sheep failed to become infected when bitten by flies infected with *T. gambiense* and on two occasions the same thing happened with goats. The possibility of domestic ruminants acting as reservoirs for *T. gambiense* has been recognized for a long time. KLEINE'S experiments on this subject for 1911 and 1913 are discussed in some detail. From these experiments it appears that monkeys were more readily infected than sheep and goats, relatively few of these animals becoming infected. Duke in commenting on this fact states that it is quite definite that KLEINE'S monkeys were in certain circumstances more susceptible to *T. gambiense* than were his sheep and goats. Whether this phenomenon depended on the strain or on the animal itself it is impossible to determine. Duke also states that he is sure from recent experiences at Entebbe that some of KLEINE'S strains must have been non-transmissible strains of *T. gambiense.*

The author then proceeds to discuss the later history of some of the 19 human strains referred to in the previous section of his work. The transmission experiments and the index tables relating to the later passages of these strains are presented in the same way. All the passages were made by cyclically laboratory fed *G. palpalis*, except where the contrary is expressly stated. The results are set forth in a series of tables and in the case of each strain the transmissibility index of the strain when it was originally obtained is compared with its transmissibility index of the later passages through various animals, i.e., monkey, sheep, and goat.

The following summary is given :—

"These experiments must speak for themselves. The inferences we are tempted to draw from them at this stage are :

"1. That, as a general rule, the transmissibility of a strain of *T. gambiense* diminishes when the strain is introduced into a sheep or goat.

"2. That after some months' sojourn in these animals, *T. gambiense* loses its transmissibility altogether.

"3. That a strain of *T. gambiense* may lose its transmissibility quite suddenly on being transferred from one host to another by cyclically infected *G. palpalis.*

"4. That, in the three patients whose strains were transmitted by tsetse fed directly on the patient the trypanosome had a higher Transmissibility Index in man himself than in the animals infected from him by cyclical transmission.

"5. That it is improbable that sheep and goats play any important part as a reservoir of this trypanosome, but a final opinion on this important point must be reserved. According to these experiments, calves are a negligible factor in this respect."

[The comment made in reference to the previous section applies equally here.]

The next section records certain transmission experiments with strains of *T. rhodesiense* recently isolated from man. Four strains are dealt with—three from the Mwanza-Ikoma infected area in Tanganyika, and one from the Belgian Congo. Information regarding the transmission experiments made with these strains and their transmissibility index is set forth in tables.

In discussing the results of his work, Duke points out that the relation between *T. gambiense* and *T. rhodesiense* is one of the questions

that the Commission had to investigate. KLEINE's conclusions are interesting and far-reaching and indicate the urgent necessity for experimental work with tsetse of the *G. morsitans* type to determine whether *T. gambiense* when transmitted by game-tsetses, after a long period of time, acquires the characters of *T. brucei*. Duke records that for some years he has advanced the view that the differences between these two trypanosomes are to be explained by the differences which exist between their vertebrate host, i.e., man and game. It is possible, however, that the fly also exerts an influence on the trypanosome it carries. Duke makes it clear that he differs from KLEINE in regard to *T. brucei*. KLEINE considers *T. brucei* to be entirely different from the two human trypanosomes which he considers to be identical. Duke also believes that the differences between *T. gambiense* and *T. rhodesiense* are differences due to environment, but he agrees with BRUCE, and with the reviewer, that *T. rhodesiense* and *T. brucei* are even more nearly related to one another. *T. brucei* and *T. rhodesiense* are the same species ; and *T. rhodesiense* is the name given to strains of *T. brucei* that can utilize man as a host. Wherever game tsetse are thrown in close biological contact with man there *T. rhodesiense* will be found if looked for. The majority of the strains of *T. brucei* are incapable of utilizing man ; in the same way a number of strains of *T. congolense* cannot infect dogs or monkeys. In the former case, the more enterprising strains have earned the distinctive name of *T. rhodesiense*, and in the latter the more conservative variety is known as *T. nanum*. The essential point of this view is that the selection is exercised by the trypanosome rather than by the mammalian host.

Viewed from this angle the much discussed experiment of TAUTE does not show that 129 natives were resistant to the species of trypanosome known as *T. brucei*, but that the six particular strains of *T. brucei*, which TAUTE took from horses and mules, could not infect man.

[The whole subject is one of great theoretical, and, undoubtedly also, of practical and epidemiological, interest. For reasons previously stated the reviewer is compelled to confess that he does not think that Dr. Duke has yet proved his point. It seems unfortunate that Duke should have used *T. congolense* to support his contention that "*selection is exercised by the trypanosome rather than by the mammalian host.*" What is the evidence that "a number of strains of *T. congolense* (*T. nanum*) cannot infect dogs or monkeys" ? The mind of the reviewer goes back to certain experiments performed by BLACKLOCK and himself in 1913. From a horse naturally infected in the Gambia with *T. congolense* eleven animals were inoculated with the following results : Of 2 goats 1 became infected and 1 did not ; of 3 rabbits 2 became infected and 1 did not ; of 4 guineapigs 3 became infected and 1 did not ; and of 2 rats neither became infected. In this case there seems to be no doubt that the selection was exercised by the mammalian host.]

The third section of Duke's report consists of an investigation of the transmissibility by laboratory-bred *G. palpalis* of eight strains of polymorphic trypanosomes from mammals other than man. These trains were :—

"(*a*) A trypanosome from East Africa sent to me from Kenya by Mr. Montgomery, Veterinary Pathologist, Nairobi, and described in 1912.

"(*b*) A strain of the Lake Victoria polymorphic organism recovered from wild-fly on the mainland shore in 1920.

"(*c*) A similar strain isolated from a situtunga antelope shot on Damba Island in 1920.

"(*d*) A wild-fly strain from the *G. swynnertoni* zone near Mwanza, isolated in 1922.

"XXIII. A strain isolated from a Damba antelope in September 1926.

"XXIV. A strain of *T. brucei* sent to the Laboratory in February 1926 by Professor Kleine.

"XXV. A polymorphic organism found by Captain Hall, Veterinary Pathologist, Uganda, in cattle from the Gomba county, in Uganda.

"XXVI. A strain of *T. brucei* from a dog infected in a *G. morsitans* area near Mbarara, in the Western Province of Uganda."

The general conclusion reached is that " these experiments convey an impression—it amounts to nothing more—that the game trypanosomes from *G. palpalis* areas have, on the whole, a low transmissibility index ; lower indeed than that possessed by strains derived from game tsetse areas."

The fourth section records further experiments on the effect of direct transmission on an antelope trypanosome of the polymorphic group. The strain was obtained from the blood of a situtunga antelope shot on Damba Island in February, 1924. The blood was inoculated into a monkey and the strain passed through monkeys by the syringe until the 34th passage, when a guineapig was introduced. By this time the strain had lost its transmissibility. Details of the plan of upkeep of the strain and of the transmission experiments are given in tables.

In the fifth section the transmissibility of trypanosomes by glossina is discussed, together with some reflections on the spread of human trypanosomiasis. The special object of the enquiry is to attempt to explain the way in which human trypanosomiasis spreads ; and attention is specially directed to the relation of *T. gambiense* and *T. rhodesiense* to the insect intermediary. The author points out that when once a trypanosome has lost the power of infecting the glands of glossina, it has only direct transmission between it and extinction on the death of its host. He refers briefly on what he has previously written on the possibility of transmission of human trypanosomiasis by the direct method by tsetse. As the result of recent work, he is inclined to modify, but not to abandon, his original views on direct transmission. Experiment has shown that this method may function for a long time without producing any effects on the strain, and conditions in which prolonged direct transmission can occur in nature must be rare. It must, therefore, still be admitted that direct transmission is one of the factors which may affect the constitution of a trypanosome in its natural surroundings. There is no evidence that a tsetse cyclically infected by a trypanosome is infective until the metacyclic forms have appeared in the " anterior station." Referring to the observations of KINGHORN, YORKE, and LLOYD that positive results may be obtained by injecting the gut contents of certain flies infected with *T. rhodesiense*, Duke states that even if this result be not explained by leakage from the glands, the combined experience of those who have worked on the subject shows that trypanosomes developing in glossina cannot be transmitted by the fly during the act of feeding, unless the salivary glands of the insect contain the metacyclic forms. [YORKE and MACFIE, 1924, found sporozoites amongst the blood in the stomach and in the ventral oesophageal diverticulum of *A. maculipennis* an hour or two after feeding. These

must have had their origin in salivary secretion, which, after being discharged into the wound, had been withdrawn with the blood into the alimentary canal. It is probable that the observations of KINGHORN, YORKE, and LLOYD, are to be explained on similar grounds.] Human trypanosomiasis never spreads in the absence of glossina, and glossina is the only insect in which these trypanosomes are known to develop cyclically. From a human point of view, therefore, the power of these trypanosomes to develop cyclically in tsetse is of supreme importance, and the transmissibility of the strain is one of its most significant attributes. The virulence of the strain appears to be entirely independent of its transmissibility. The manner in which the trypanosome loses its power to develop in tsetse is discussed. The capacity to invade the salivary glands disappears first. The final stage consists in the complete loss of power to develop even in the gut.

Passing to the various factors which may influence the transmissibility of the trypanosome, Duke considers four possible explanations. The determining cause may be (1) the Fly; (2) the Climate; (3) the Vertebrate, and (4) the Trypanosome itself.

(1) *The Fly.*—Miss ROBERTSON concluded that the physiological variations of individual flies played little or no part in determining the percentage of flies which are infected by different strains of trypanosomes. She decided that the explanation lay rather in the properties of the trypanosomes taken up by tsetse. KLEINE reached the same conclusion, and Duke's own experiments likewise lead him to support this conclusion, because :—

(*a*) Different strains possess different degrees of transmissibility when first isolated from their natural host.

(*b*) Non-transmissible strains are consistently non-transmissible, no matter how many tsetse are employed in their investigation. [This fundamental statement does not in the reviewer's opinion rest on any solid foundation of proof.]

(*c*) The extent to which flies become infected when fed on an animal varies according to the day or days on which they are fed.

(*d*) The diet of the fly appears to exert no effect on the development of the flagellates, nor does their presence appear to harm the fly in any way.

(2) *The Climate.*—ROUBAUD and BAGSHAWE both put forward the suggestion that climatic conditions may affect the transmission of trypanosomes by tsetse. ROUBAUD's results, however, are explicable on the assumption that he was working with non-transmissible strains, and KLEINE's experiments are also explicable on the same basis. The observations of KINGHORN, YORKE, and LLOYD on the effects of climatic conditions on the cyclical transmission of a trypanosome by tsetse are referred to; but it is considered unlikely that seasonal conditions in any given area will be sufficiently pronounced to produce a similar effect to those obtained in their experiments.

(3) *The Host.*—It can be affirmed with some confidence that of the mammalian hosts ordinarily available to the trypanosome in nature, no species exerts a definite and immediate inhibitory effect on the transmissibility of the parasite by tsetse; but more than this cannot be said.

4. *The Trypanosome.*—As a result of the experience of previous workers, Duke was led to the conclusion that the transmissibility of a trypanosome by glossina is a function inherent in the trypanosome itself. The work of ROUBAUD and KLEINE suggesting the existence of non-transmissible strains is briefly referred to, as is also that of REICHENOW (1921), who reported the existence of non-transmissible strains of *T. gambiense* in man himself. REICHENOW found that flies fed upon "old cases" of human trypanosomiasis did not develop infections in the salivary glands. This was not Duke's experience, as in all his advanced cases the trypanosomes were transmissible.

The fifth section consists of notes on the bionomics of the polymorphic trypanosomes on Damba Island.

Following the report are a number of appendices.

Appendix A describes an investigation of the action of "Bayer 205" on *T. gambiense* developing in *G. palpalis*, and shows that the drug apparently exerts no sterlizing effect on tsetse infected with *T. gambiense*.

Appendix B. Experiments here described indicate that it is immaterial to a young laboratory-bred fly whether it feeds before its first infecting feed or not.

Appendix C deals with the nomenclature of human trypanosomiasis in native African languages and its possible bearing on the antiquity of the disease.

Appendix D consists of a few remarks concerning the resistance of *T. gambiense* to arsenic.

Appendix E describes a few experiments dealing with the possible chemotactic influence of the salivary glands of glossina on the development of the polymorphic trypanosomes in tsetse.

III. **Reports.** By G. LAVIER. [pp. 117–141. With 3 figs.]

The first section of Lavier's contribution deals with an attempt to infect baboons with *T. rhodesiense.* The natural resistance of these animals is well known and the author endeavoured to lower it by infecting them with various helminths, *Treponema duttoni* and tuberculosis. The attempt to break down the immunity by such methods, however, ended in failure, as did also an attempt to infect them by suboccipital puncture.

The next section is concerned with a morphological study of isolated strains at Entebbe laboratory. The main results of this work have appeared elsewhere and have already been noticed in this *Bulletin.*

IV. **Reports.** By M. Maximo PRATES. [pp. 143–244. With 80 figs.]

After indulging in some brief notes on the microscopic diagnosis of trypanosomiasis, the author passes to a consideration of the posterior nuclear forms of polymorphic trypanosomes. He states that the percentage of posterior-nuclear forms in recently isolated *T. gambiense* is manifestly lower than in recently isolated *T. rhodesiense* infections.

The third section deals with the Gaté-Papacostas reaction (formol-gel test) in the diagnosis of trypanosomiasis. The following are the conclusions :—

"1. As there exist in tropical regions, in addition to trypanosomiases, various other diseases of man or animals which also give a positive formol-gel reaction, the test alone cannot be relied on in the diagnosis of any one of these affections.

"2. When formol jellification is *negative* in a person or animal suffering from a chronic disease affecting the general health, it is unlikely to be a case of trypanosomiasis or any of the other chronic affections producing more or less rapid serum jellification such as syphilis, yaws, tuberculosis, leprosy, malaria, kala-azar, East Coast fever, etc.

"3. In the absence of more certain data, the formol-gel test may furnish certain presumptive evidence of assistance in the diagnosis of advanced chronic diseases about which information is available as to the positive or negative formol-gel reactions generally associated therewith.

"4. Human and animal trypanosomiases and various other chronic tropical affections give negative formol-gel reactions only in exceptional cases, and this generally at the beginning of the disease.

"5. The drugs which act most effectively on the disease affecting the organism from which the blood-serum has been taken exercise the greatest influence on formol-jellification, inasmuch as reactions which were previously positive become negative or at least greatly retarded.

"6. I did not find that the serum of persons or animals infected with *T. gambiense, brucei* or *rhodesiense* to which had been added *in vitro* "Bayer 205" or tryparsamide showed any specific characteristics that could serve to differentiate between these trypanosomes.

"7. The formol jellification of the serum appears to depend not so much on the intensity of the infection or infestation, as evidenced by the number of virulent micro-organisms found, as on the gravity of the disease as determined by general symptoms, both objective and subjective, affecting the animal's general state of health.

"8. Employed in clinical examination (examination of candidates for sickness insurance) or the examination of stock, a positive formol-gel reaction may serve to indicate the existence of certain chronic diseases."

The fourth section records attempts to culture polymorphic trypanosomes. The following summary and conclusions are given :—

"1. In Ponselle's medium, in which Ponselle cultivated different pathogenic trypanosomes (*brucei, pecaudi, rhodesiense* and *dimorphon*) with absolutely constant results, "all the tubes inoculated giving abundant growth both in original cultures and in subcultures, which can be carried on indefinitely," I obtained cultures of *T. gambiense, T. rhodesiense* and *T. brucei* and also of the Damba-antelope trypanosomes, though with a lower percentage of positive results.

"2. I cultivated all these trypanosomes in the same Ponselle medium, with the same sodium-chloride concentration.

"3. I found no morphological difference between the various polymorphic trypanosomes at any stage of the cultures : all, no matter what the medium, exhibited the recognized morphology found in the gut of glossinae. Nor did I observe any metacyclic or blood forms.

"4. Rabbit serum may be replaced by monkey serum in Ponselle's media for the cultivation of the pathogenic trypanosomes of African mammals.

"5. When inactivating Ponselle's media for the cultivation of pathogenic trypanosomes in the higher mammals, the temperature may be allowed to go up to from 70° to 75° (this is even desirable) when the medium assumes consistency of a viscous jelly.

"6. I inoculated *Cercopithecus* monkeys and white rats with cultures containing an abundance of trypanosome like flagellates—15, 30, 40, 45, 50, 60 and 65-day cultures—but did not succeed in infecting any of the animals. I repeated several inoculations, after keeping the trypanosome cultures in an incubator at 37° for 24 hours ; the results, unlike those obtained by Nöeller, were also negative.

"7. Some of the animals which had been given repeated injections of cultures at different stages of development were subsequently inoculated with sanguicolous trypanosomes of the same species, and did not exhibit any appreciable degree of immunity.

"8. I applied various boxes of "fresh" glossinae to monkeys inoculated with cultures, and the flies which sucked them did not become infected.

"9. The existence of bacteria in Ponselle's media and the cultivation of the polymorphic trypanosomes of African mammals appear to be incompatible; trypanosomes always disappear from contaminated cultures after a few days.

"10. I have tried to cultivate the blood and cerebro-spinal fluid containing occasional *gambiense* trypanosomes, in order to see if the method could be used for the diagnosis of this form of trypanosomiasis. All the cultures were negative in cases in which microscopic diagnosis had been difficult and the percentage of positive cultures was so low even when the microscopic diagnosis had been easy, that, unless the cultural method should give better results in the hands of some other investigator very slight assistance—if, indeed, any—in the diagnosis of the trypanosomiases in question can be looked for.

"11. I found no confirmation of Ponselle's suggestion that the differences in the osmotic pressure required for cultures of the various pathogenic trypanosomes may supply useful indications as to the receptivity of different tsetse-flies for the various species of trypanosomes. On the one hand, all the trypanosomes that I cultivated (*brucei*, *gambiense* and *rhodesiense* and those of the Damba antelope) completed the same evolutionary cycle in *Glossina palpalis*, at the Entebbe Laboratory (Dr. Duke's experiments); on the other hand, I cultivated all these trypanosomes in the same Ponselle medium, prepared with no matter which of the sodium-chloride concentrations.

"Ponselle himself described *T. brucei* and *T. rhodesiense* (both transmitted in nature by the same glossinae) as demanding very different osmotic pressures (0·3 per cent. for *T. brucei* and 0·8 per cent. for *T. rhodesiense*) and *T. rhodesiense* and *dimorphon*, on the contrary (transmitted by different flies) as requiring the same pressure (0·8 per cent.)."

The fifth section describes in great detail experiments devised with the object of applying the precipitin test for the recognition of the blood found in the alimentary canal of Glossina. The conclusions reached from this work are as follows:—

"1. When applying the precipitin test to blood found in the alimentary canal of *G. palpalis* caught on the banks of Lake Victoria, near the Entebbe Laboratory, I found, out of 2,150 tsetse-flies dissected, 186 (8·6 per cent.) containing blood. With these 186 flies I obtained 43 (23 per cent.) positive precipitin reactions: 6 with anti-human serum (out of 45 reactions), 21 with anti-monitor (lizard) serum (119 reactions), 6 with anti-crocodile serum (31 reactions), 4 with anti-hippopotamus serum (28 reactions), 2 with anti-ruminant serum (19 reactions), and 4 doubtful reactions, one with anti-ruminant serum, a second with anti-bushbuck, a third with anti-Situtunga (antelope) serum, and, lastly, a fourth with an anti-serum prepared with hen's blood and the blood of various water-birds.

"The results would presumably not be the same in another fly-belt, where the fauna would be different from those studied at Entebbe. If, for example, the anti-Situtunga serum were applied to the blood in the gut of tsetse-flies on the islands in Lake Victoria, where the blood of this antelope constitutes the chief food of *G. palpalis*, I am convinced that a higher number of positive precipitin reactions would be obtained than I got with the flies caught near the Entebbe Laboratory.

"2. There is reason to believe that, whenever they have any choice, tsetse-flies show a preference for certain animals; but my experiments on the precipitin test and the experimental application of wild and laboratory-bred glossinae to numbers of zoological species, whose blood they finally sucked more or less readily, point to the fact that tsetse-flies, essentially blood-sucking insects, can feed on the blood of any animals

that are found habitually in or may happen to visit places in which they themselves find a suitable environment for living and breeding (temperature, humidity, shade, nature of the soil, etc.).

"3. The first observers to study the precipitin test noted that the action of pepsin, and particularly of trypsin, had a marked effect on the intensity of precipitin reactions.

"Hektoen, Fantus and Portis (1919) proved that extracts of the faeces of healthy persons living on an unrestricted meat diet rarely gave positive reactions with anti-sera prepared with the antigen of the animals (ox, goat, sheep, hen, etc.) on which man generally feeds, showing that, ordinarily, foreign proteins which enter the stomach are not found in the same state in the faeces.

"When engaged in comparative tests with sera with a high precipitin content and homologous antigens, before and after digestive action in the glossinae, I myself found that digestion has a very marked effect on the intensity of the precipitin reaction. With blood containing red cells clearly recognisable under the miscroscope, taken from glossinae experimentally fed on specific animals, I often failed to obtain positive reactions, though I had employed sufficiently active homologous anti-sera, producing well-marked positive reactions in the control tubes.

"4. In practice, the fly-boys only catch tsetse-flies that have come out for the purpose of biting them, and these do not contain any blood but are, on the contrary, in search of it. Only in 8·6 per cent. of the flies caught did I find any vestiges of blood still recognisable on microscopic examination. This blood, however, was so modified by the digestive ferments in the fly that I only obtained 2 per cent. feebly positive precipitin reactions, despite the special technical precautions I took to overcome the difficulties encountered and to make sure of the modest results obtained with specimens of blood less modified by digestive action in the glossinae. The few well-marked *positive* reactions were obtained with anti-human serum, probably because the blood in the glossinae had been quite recently sucked from the fly-boys themselves, without the flies' digestive ferments having had time to modify its antigenic properties to any great extent.

"The expedients that I adopted to overcome the various difficulties I encountered constitute the only original part of my contribution to this work, which I have been obliged to describe at greater length than I could have wished.

"5. The complement fixation test, in a laboratory suitably equipped for Wassermann reactions, should furnish more fruitful results than the precipitin test in identifying the blood found in the alimentary tract of glossinae."

The sixth section contains an account of haemoparasites found in Glossina. This study was undertaken with a view to the identification of the blood in their intestine.

The last section of Prates' report is a general account of the organization of experimental work on Glossina at the Entebbe laboratory. It is illustrated by numerous photographs.

V. **Pathologico-Anatomical and Serological Observations on the Trypanosomiases.** By M. Peruzzi. [pp. 245–324. With 24 figs. & 2 coloured pls.]

The first of this very interesting and important series of articles deals with the pathogenic potency of some trypanosomes. The various pathological lesions found in a considerable number of infected monkeys are described in great detail. The following are the general conclusions reached :—

"The post-mortem and histological study of fifty-three monkeys, of which forty-three were infected with recently isolated strains of trypano-

somes of human and animal origin, has brought to light the susceptibility of these monkeys (*Cercopithecus* sp.) to present the most diverse manifestations of trypanosomiasis, and the relation between the specific lesions and the extraneous complications (malaria, filariasis, helminthiasis, cerebral porosis, bacterial infections).

"The variety of the morbid anatomical lesions thus provided very favourable conditions for the comparative study of the strains used and their pathogenic connections. The results of this study enable us to distinguish three pathogenic types :

"I. Chronic manifestations, with few trypanosomes, approaching in a few weeks (four to eight) sclerotic and infiltrative lesions of the haematopoietic organs, characteristic meningo-encephalitis, sclerosis of the myocardium and cachectic phenomena, predisposing the monkeys to extraneous complications.

"This group characterises the pathogenic action of human trypanosomes of the *G. palpalis* regions.

"II. Rapid manifestations, with numerous trypanosomes, approaching in a few weeks (two to four) terminal lesions, characterised by hyperplastic and haemorrhagic phenomena in the haematopoietic organs, by true specific myocarditis, serositis and nephritis, by the early passage of the parasites into the cerebro-spinal fluid and lesions in the choroid plexuses.

"This group characterises the pathogenic action of the human and animal trypanosomes of the *G. morsitans* and *G. swynnertoni* regions.

"III. Irregular manifestations of an intermediary type, tending to reach in a few weeks (eight to ten), or even some months (eight to fourteen), lesions of the first or second type, and most frequently to chronic lesions associated with rapid terminal lesions.

"This group characterises the pathogenic action of trypanosomes of animal origin, of *G. palpalis* regions (Damba Island).

"Nevertheless, it must be noticed that there are some very great differences, and numerous important exceptions, due either to individual resistance, or to pathogenic potency, which is extremely variable in recently isolated strains; these differences prevent any grouping of some border-line forms among the most rapid of the first group and the slowest of the second. Some cases, from reputed *G. palpalis* regions, suggest the existence of other glossinae, or that the patients had contracted the disease elsewhere; and the pathogenic manifestations in monkeys sometimes singularly agree with the results of morphological research.

"The morbid anatomical process was always the same, with local manifestations more or less important, according to the number of parasites, which all showed their tendency to localize themselves in the interstitial spaces of the tissues and in the serous-membrane fluids.

"The most considerable localisations determine, in the first stage, exudative infiltrations of polynuclears and lymphocytes; afterwards, the mononuclears and macrophages are added, while the capillaries are the seat of serious trouble (oedema, haemorrhage by diapedesis, endothelial proliferation). These elements, as well as the parasites, are gradually absorbed by the lymphatic ducts; some plasma cells and some lymphocytoid and polymorphous histiocytes persist a long time in the form of abundant interstitial infiltrations, until the complete development of elements capable of fibroblastic activity.

"This process has all the characteristics of granulomatous inflammations and it may attain to definite histological transformations in the form of cirrhoses.

"The most remarkable manifestations affect the myocardium, the serosae, and the kidneys. More moderate infiltrative changes may affect the liver, the suprarenals, the meninges and the vascular terminations of the nerve centres, the genital organs, the salivary glands, the alimentary canal and present local symptoms that are sometimes of great importance.

"Small perivascular infiltrations are also demonstrable in almost all the tissues of the organism, owing to the ubiquity of the trypanosomes in the interstitial spaces rather than in the blood.

"Hyperplastic, haemorrhagic, and sclerotic changes are manifested in the haematopoietic organs; they are due to their cathaeretic function, as well as to the direct action of the living parasites.

"The results of these post-mortems enable one to explain the pathogenic power of the trypanosomes studied; one can also say that they have brought to light the most faithful experimental reproduction of human lesions obtained till now and that they have called attention to new questions which must be carefully studied in man, such as serositis and cardiopathy."

The next section describes the trypanosomes in the lesions, massive localisations and cellular invasions. The following is the summary:—

"At the sight of lesions, the trypanosomes have generally the same form as in blood drawn off from the periphery; but in massive localisations they show a very accentuated polymorphism, which seems related to their power of invasion.

"In certain tissues (myocardium, kidney, suprarenal), one can find typical trypanosomes, or leishmanoid forms. These manifestations of cellular invasion have characteristics which show accidental relationships with the protoplasm, changed or vacuolised by a regressive process, and do not show the phases of an intra-cellular cyclical evolution typical of other trypanosomes. It is a case of manifestations of malignity which almost always characterises the trypanosomes of *rhodesiense* type and very often those of the Damba-Island antelopes.

"The most extensive localisations in the monkey were found in the myocardium, where they caused myocarditis; in the choroid plexuses which favour early penetration into the cerebro-spinal fluid, and into the fluids of the serous membranes, where the trypanosomes were to be found even when their presence in the blood had not been proved. The trypanosomes are easily visible in tissues stained with haematoxylin-eosin, provided that the post-mortem phenomena are not advanced and that bacterial infections have not produced complications."

The third section contains a description of trypanosomal myocarditis. The work is summarized as follows:—

"Trypanosomal myocarditis frequently causes death in inoculated monkeys.

"The lesions are due to massive deposits of trypanosomes, which multiply in the myocardium, external to the vessels.

"They become manifest in the first stages by infiltrations which are rich in macrophages, in mono- and polynuclear cells and in leucocytes. In advanced and chronic conditions one finds infiltrations of polymorphic, lymphocytic and plasma cells, and confluent foci of fibrosis.

"These forms of myocarditis are always associated with exudative pericarditis. The gravest and most frequent forms are due to trypanosomes of human or animal origin conveyed by *G. morsitans* and kindred species and to trypanosomes of animal origin conveyed by *G. palpalis*.

"Less acute forms are found in infections caused by trypanosomes of human origin conveyed by *G. palpalis*.

"These latter forms correspond without doubt to the human lesions described in the earliest publications on the pathological anatomy of sleeping-sickness, ascribed to the *gambiense* strain.

"In view of the cardiac disturbances, sudden deaths and premature fatal issue of the malady noted in human infections due to strains of *rhodesiense*, it is extremely probable that in these forms the cardiac changes are very severe and sometimes more important than the changes in the nervous system.

"Researches on this subject would surely yield interesting results."

The fourth section describes the changes found in the choroid plexuses and the entry of trypanosomes into the cerebro-spinal fluid. It is stated that :—

"The choroid plexuses are the site of early extravascular deposits of trypanosomes of human and animal origin from *G. morsitans* and *G. swynnertoni*.

"These penetrate into the cerebro-spinal fluid in large numbers, but are rapidly destroyed, not finding conditions favourable to their survival.

"The degree of these lesions is not proportional to the vascular lesions of the meninges and of the nervous tissue. The cerebro-spinal fluid is a defensive mechanism against the invasion of trypanosomes until its albuminoid content is raised. It contains demonstrable trypanosomes when the phenomena of meningo encephalitis are definitely established. This happens particularly, but not exclusively, in advanced forms of chronic trypanosomal infections, caused by strains of human or animal origin from *G. palpalis*, and also when the changes in the cerebro-spinal fluid are very pronounced."

In the fifth section the origin and histological relation of the morula cells in trypanosomal meningo-encephalitis is discussed. The author concludes that :—

"Morular cells are cells with fuchsinophile hyaline globules analogous to cells found in granulomata. They have, perhaps, in trypanosomal encephalitis a multiple origin, but the features and relationships they present in the different phases of their evolution indicate neuroglia as their most frequent origin.

"The transformation of satellites of the nerve cells into morular cells determines grave changes in the nerve cells, particularly in the grey matter of the bulb, the protuberance and the basal ganglia."

In the next section a condition of cerebral filariasis is described in five monkeys infected with trypanosomal meningo-encephalitis. The following is the summary :—

"A cerebral and bulbar localisation of adult filariae was observed in five monkeys (*Cercopithecus*) infected with vascular lesions and alterations in the cerebro spinal fluid due to trypanosomiasis. The percentage of this localisation, the relation between the quantity of parasites and the duration of the trypanosomiasis, and the results of examination of the cerebro-spinal fluid at different periods would lead us to suspect that the localisation took place during the captivity of these monkeys and in the course of the trypanosomiasis, caused or facilitated by the alterations in the cerebro-spinal fluid.

"No pathogenic rôle can for the moment be assigned to the cerebral filariasis so far as concerns the local lesions, but grave bulbar phenomena and apparent death occurred in a case where the parasites were very numerous."

The last section is concerned with the question of immunity and the protective action of baboon serum. As the result of his experiments, the following conclusions were reached :—

"A strain of *T. rhodesiense* behaved differently towards treatment with baboon serum in two guineapigs of the same size, inoculated at the same time and with the same quantity of virus at the 2nd passage ; a further difference appeared when this strain, which in one guineapig appeared to be naturally serum-resistant, was transferred to another.

"Serum-resistance, then, would appear to be a property of the host rather than of the trypanosome.

"A trypanocidal action *in vitro* is manifest when baboon serum is in the presence of hepatic tissue taken from still-living infected animals ; and in

these circumstances is more rapid and intense than when we are dealing with infected animals which have been previously treated with the same serum.

"The numerous attempts to transmit to cynocephalics a strain of *T. rhodesiense* serum-resistant in the guineapig, a strain of *T. brucei* derived directly from a naturally infected dog, and a trypanosome from *G. palpalis* derived from a Damba antelope gave negative results. Inoculations of exudates very rich in living trypanosomes were made into the serous membranes and into the myocardium, where trypanosomes develop most easily in predisposed animals.

"Nevertheless, the survival of trypanosomes for more than twenty-four hours in the baboon, the local reactions observable in the subcutaneous tissue and in the *tunica vaginalis* together with phenomena exactly similar to those in predisposed animals, as also the differences found according to the site of inoculation, show that the limits of immunity have been reached.

"Further researches on serum-resistance of human strains at the first passage, and on the infection of cynocephalics by direct or cyclical transmission starting from man, are still necessary."

Peruzzi's papers are illustrated by a number of micro-photographs and two beautiful coloured plates.

VI. Epidemiology of Sleeping-Sickness in the *G. palpalis* and *T. gambiense* Areas. [pp. 325–388.]

This section consists of the following six papers which deal mainly with the epidemiology of sleeping sickness in *G. palpalis* and *T. gambiense* areas :—

1. *Sleeping Sickness in the Semliki Valley.* By L. VAN HOOF. [pp. 329–345.]

The author and Dr. LAVIER left Entebbe on December 7th, 1926, to visit the foci of human trypanosomiasis which in the last few years has decimated the southern half of the fertile valley of the Semliki. The few weeks at their disposal were too short to allow the carrying out of a regular epidemiological enquiry, and consequently the investigation was limited to an examination of certain places where infection was epidemic, and to an attempt to ascertain the cause of this state of affairs and to contrast these areas with zones where endemicity is low.

The following are the general considerations and conclusions :—

"1. *Abundance and Distribution of Glossinae.*—Although not very numerous, *palpalis* are found on all the rivers, lakes, etc., their habitat extending without interruption as far as the areas of Irumu, the Chari-Ituri river, the Ituri forest, Lake Edward and Lake George, Katwe, Bamba and Wasa, east of Ruwenzori.

"2. *Density of Population and Natural Resistance.*—Conditions have changed since the evacuation of the valley, where only isolated groups are now left. On the slopes, however, there are thickly populated settlements over which it is difficult to exercise supervision and, chiefly towards the frontier, the natives, who are intractable and often insubordinate, move about on the slightest pretext from one *palpalis* zone to another. There, wherever the compact groups of Bahimas are settled, a dense population is to be found round certain definite tsetse breeding-grounds. Their natural power of resistance, so far as it counts, is comparatively low in regard to all forms of infection, despite the fertility of the soil and their numerous and plentiful crops. A mixture of very different races is found, from the Bahimas to the forest pygmies. Their standards of morality and intelligence are below the average.

"3. *Circumstances which favour Close Contact between Man and Glossinae.*—(*a*) Dwellings in the vicinity of glossinae breeding-places. Notable examples, namely, Old Beni and the Mission, have already been quoted, in which the natives and even the Europeans are exposed every day.

"(*b*) Existence of breeding-grounds of glossinae which feed exclusively on man. There are springs and streams where the natives go to fetch water all day long and where neither reptiles nor game exist to divert the fly. These conditions already exist in some of the new sites (for example, Bungulu) to which settlements have been moved.

"(*c*) Native industries and occupations. Reference was made to these above, the most important being fishing, canoe building, and the cultivation of plantations near the rivers; all are prohibited by the Administration, but are none the less practised clandestinely. To these must be added the following: the house-to-house trading in salt; cattle-breeding in the plain; trade with neighbouring territories; exchanges of labour; the purchase of women between Bwamba and the Banande; the traffic in hemp; the exchange and migration of cattle between the Bahimas of Molekera and those of Bwengo, and perhaps of many other parts of Ankole; administrative, scientific and also hunting expeditions, the native porters being obliged to enter the old focus in the plain, often without any provision for medical supervision when they are exposed to infection.

"4. *The Virulence of the Trypanosome,* so far as it can be estimated from the clinical evolution of the disease, the index of mortality, the efficacy of the regulation treatment and, in certain cases, natural resistance to atoxyl.

"Other factors, and most important ones, are still uncertain and would have required considerable additional research both on the spot and in the laboratory. We do not possess data to show the degree of infectiousness of the virus or the "index of transmissibility," which Dr. H. L. Duke might have established at Entebbe, if it had been possible to bring back a sufficient number of strains. Lastly, we have only very vague ideas as to the number of virus-carriers in this area, where chemical prophylaxis has been employed for many years with so little success.

"From the purely practical standpoint, however, I feel justified in drawing the following conclusions:—

"1. The endemic in the Semliki area is serious, the virus may be described as of average strength and to-day, as in the past, shows a tendency to spread, creating fresh foci in the *palpalis* distribution area.

"2. The nature of the virus, the biological conditions of the glossinae and the opportunities for contact between them and man are responsible for this. There is every likelihood that the endemic will spread beyond its present limits and that the virus, which is sometimes arsenic-fast, may spread through the neighbouring territories.

"3. In the present case, the natives possess no safeguard against infection, but will, on the contrary, be the first to spread it, by reason of their migratory habits and racial ties. The effects of chemical prophylaxis are thus bound to be checked by the continual importation of fresh strains of trypanosomes, until supervision over the movements of persons and over traffic in general becomes the rule and the foci where the glossinae depend exclusively on man can be evacuated or cleared by means of deforestation."

2. *Epidemiology of Sleeping-Sickness in the Upper Uele (Belgian Congo).* By H. Lyndhurst Duke and L. van Hoof. [pp. 346–362. With 4 maps.]

The endemic zone of Upper Uele was chosen for this enquiry because this district, while easily accessible, constitutes a group of foci well

separated from those of Uganda and of the Semliki Valley, and could provide different clinical observations and different strains of trypanosomes.

Little is known of the history of the disease in this district, but there is some evidence that it has been there for a long time. It is probable that formerly the endemic wave spread from the north-west towards the south and east. Several maps of the district are given. On their journey the authors came into contact with the Belgian anti-trypanosomiasis medical organization: a general programme of their activities is given. It consists of (1) Complete census of the population and patients; (2) Rational and complete treatment of all patients; (3) Evacuation of dangerous zones; and (4) Deforestation and sanitation of infested villages and river-crossings.

Only six weeks were available to cover an enormous area; an account of the itinerary is given, and it is stated that in addition to epidemiological researches proper, the author's aim was to collect human trypanosomes and cattle and game trypanosomes, to make observations on Glossina and possibly to collect their flagellates with a view to subsequent laboratory work.

A general account of the country is given. *G. palpalis* is present practically all over the complicated system of the Uele rivers, and the authors gathered the impression that a large part of the population is constantly exposed to the fly and particularly so during the rainy season. The flies have also a large choice of other hosts, notably reptiles and game; and it is clear that crocodiles, and also monitors and perhaps the large snakes, constitute a very important item in the diet of the fly. The Glossina captured on the Uele, the Kibali, and the Dungu, where crocodiles abound all the year, contained *T. grayi* in the proportions of 13 and 22 per cent. respectively, whereas flies caught on the small rivers, where in the dry season there are no crocodiles, revealed no flagellates. Only one other species of Glossina was seen, viz., *G. fusca* or *brevipalpis*, a single specimen of which was captured in very dense forest. During the visit to the Kawa forest on the western bank of Lake Albert, *G. pallidipes* was found to be abundant in the close vicinity of *G. palpalis*; twenty-five were dissected, but no flagellates were found.

The authors state they cannot speak authoritatively about the number of game present in the district, but they believe that, owing to unrestricted hunting on the part of the natives, the game was rapidly growing scarcer. Elephant, white rhinoceros, hippopotamus, buffalo, giraffe, river-hog, wart-hog, water-buck, bush-buck, hartebeeste, bongo (*Boccercus*), cob, a large unknown species of forest cephalophoid and the "oribi" were observed. Of these, elephant, buffalo, bush-buck, water-buck, hartebeeste, cob, and wild pig are widely distributed throughout the whole area, and certainly play a part, though probably a small one, in the diet of *G. palpalis*. Apart from man the principal hosts appear to be crocodiles, wild pig, and hippopotamus.

Information based largely on documents provided by the Belgian Mission is given regarding the six foci into which the area is divided.

Aba-Faradje Focus.—It is uncertain whether this is really a focus, as most of the cases diagnosed were proved to be imported. The authors visited part of the focus, but were unable to find evidence of sleeping sickness.

Dungu Focus.—In this district cases of the disease are only exceptional. In 1926, 26,901 persons were examined, but only 9 new

cases of the disease were discovered. Although all the rivers are infested with Glossina and the natives are frequently exposed to their bites, and notwithstanding frequent introduction of the virus from neighbouring districts, the infection shows no tendency to spread. A small quantity of live-stock has been introduced at Dungu and a single examination of a small herd showed about 23 per cent. of the animals to be infected with *T. vivax* and *T. congolense*. Despite this the mortality during the last few years has not been great.

Niangara Focus.—A few sporadic cases are found, particularly to the south of the Uele. It is interesting to note that south of this focus the river Bomokandi, although thickly infested with Glossina, continues to be free from infection.

Amadi Focus.—This focus is comparatively recent and knowledge of it dates to 1925, when 10 new cases were suddenly discovered. Probably all these were imported, and since 1926 no new cases have been discovered.

Bangaro Focus.—This is the most heavily infected region of the Upper Uele. In 1924, 3·59 per cent. of the population was found to be infected, and in 1925, 1,557 patients were undergoing regular treatment for the disease. During 1926, 223 new cases were discovered as against 270 during the previous year.

Doruma Focus.—This focus, although not as important as that of Bangaro, nevertheless constitutes a danger for the Amadi districts and the Dungu territory with which trade relations are increasing.

Regarding the Upper Uele district as a whole, it is apparent that the efforts of the Medical Service during the last three years have been crowned with success and that the disease is abating. In the authors' opinion the causes are as follows: (*a*) As complete as possible a census of the natives; (*b*) chemical prophylaxis; (*c*) creation of the road system; and (*d*) prohibition of certain areas.

An experiment was undertaken with a view to ascertaining the preventive action of "Bayer 205." The experiment was undertaken with the employees of the Kilo-Moto mines, which, in 1926, established prospecting camps in the thick of the infected zone on the Kibali. As in 1926, four cases of sleeping sickness occurred in natives of non-infective districts who had recently come to work in the infected zone, it is concluded that the Glossina of the Kibali can infect man. The employees were divided into two groups, one of which received 2 cgm. of "Bayer 205" per kilo. of body-weight, and the other of which received no treatment and were used as controls. So far, however, the experiments have been entirely negative, as no case of the disease has been discovered, either amongst the treated or amongst the controls. The authors state that they fear the duration of the preventive action of Germanin has been grossly exaggerated, but from experiments now in progress, and which will have to be continued for several years, it is hoped to obtain conclusive results.

Short though their tour was, the authors were able to collect sufficient observations and information to form an opinion of the biological problem in the area. They consider that in the Upper Uele there is a virus of average strength and that this virus is distributed in a very sporadic manner. *G. palpalis* were everywhere, but only in very small numbers. The natives themselves are also everywhere and never in compact settlements. In view of (1) the small percentage of flies whose salivary glands become infected, (2) the percentage of

natives carrying the virus (local maximum about 7 per cent., general maximum 0·3 per cent., (3) the percentage of meals made by Glossina on man in comparison with other hosts, and (4) the probable percentage of strains cyclically not transmissible, the authors believe that there is no likelihood of sleeping sickness spreading to any considerable extent at least in the near future and in existing circumstances.

3. *Epidemiology of Sleeping Sickness in Budama and Kavirondo. Additional Notes and Various Observations regarding Treatment.* By L. VAN HOOF. [pp. 363–378.]

The following are the general considerations, summary and conclusions :—

" For the epidemiological survey of a country, especially from the point of view of sleeping-sickness, no factor—economic, pathological, ethnological, or other—is devoid of importance ; moreover, factors which appear to have no influence upon the biological conditions of an endemic or epidemic may require to be considered when prophylactic measures are being undertaken. This appears to me a sufficient excuse for any tediousness in these reports, which, I may add, are still very incomplete and will continue to remain inaccurate in many ways until they have been tested by many years' experience. Further, the experiments which appear conclusive in this survey are conclusive only for that particular place and that particular time ; investigations of this kind, carried out on a uniform plan, must be repeated wherever the disease exists, and repeated again and again.

"The enquiry in the Budama district and Kavirondo was begun at the end of February 1926, and the last visit of inspection was carried out in May 1927. Climatic conditions during these fifteen months were substantially unaltered, and what is lacking in these observations, therefore, is a study of the general aspect of the area during one of the usual droughts and famines. It is, moreover, obvious that in certain parts of this country the population is now rapidly increasing, principally in Busitema, where numerous natives who had left, either of their own accord or by order of the authorities, are returning to their former fields. More especially in the neighbourhood of the Bulugwe hills, which were formerly decimated by sleeping sickness and where, at the beginning of our enquiry, there was neither population nor fly, natives and even Europeans are now growing crops and establishing enterprises.

" This state of affairs may increase the density of the population in other areas from which the fly has not disappeared, as, for instance, on the shores of the lake or the banks of the Mpologoma and Namatala. Very close contact may thus be re-established between man and fly, such as probably existed for many years before the great Uganda epidemic.

" Will another epidemic necessarily follow from this new situation ? There is nothing to prove that it will be so. In various districts in the Belgian Congo—for instance, on the banks of the river Bomokandi—trypanosomiasis has not yet obtained a footing, although trypanosome-carriers have several times been introduced. It is essential that the virus introduced should be highly contagious, and, as has been proved by the recent experiments of Dr. H. Lyndhurst Duke in the case of isolated strains in various parts of Central Africa, that it should be readily transmissible by glossinae infected in the salivary glands.

" Presented in this way, the problem of the spread of trypanosomiasis appears in a new light, and we must deduce therefrom the practical measures to be adopted in the campaign against sleeping sickness. The first measure will be to watch any fresh virus introduced into an area which, owing to its biological conditions, is likely to develop a further outbreak of an epidemic, whether it is at present immune or in a stationary endemic state.

"A fact upon which I have already insisted in these supplementary notes is the limited area of the 'danger zones,' where it appears certain that natives become infected one by one and from time to time renew the stock of transmissible trypanosomes in the tsetse. As is the case at the edge of the Busembe cliff, it seems to me that these complex reservoirs of trypanosomes are extremely small in area and consequently easy to destroy. Prophylactic measures should therefore take account of this fact and an endeavour be made to discover the reservoirs.

"Generally speaking, the conclusions of the first enquiry in Budama and Kavirondo still hold good. A few further deductions can be made with regard to the practical prophylaxis and the therapeutics of sleeping sickness.

"1. As regards prophylaxis:

"Necessity for supervising the movements, and consequently for a census and identification, of the natives.

"Discovery and destruction of danger-points where the biological conditions necessary for the maintenance of the endemic exist. These places, which are comparatively few in number and very limited in area, can be improved without any great labour or mass removal of the natives.

"Efficacy of chemical prophylaxis when combined with the above measures.

"2. As regards therapeutics:

"Remarkable efficacy of tryparsamide, which should be used systematically in all cases where possible. Sulphoxyl-salvarsan and bismuth-tryparsamide are of no practical value. 'Bayer 205' should be reserved for arsenic-fast cases and provisionally as a preventive to be given to natives who are obliged to work under conditions which make them liable to infection."

4. *General Remarks on Sleeping Sickness in the* T. gambiense *and* G. papalis *Regions based upon Researches carried out in Budama, Kavirondo, the Upper Uele and the Semliki Valley.* By L. VAN HOOF. [pp. 379–381.]

This short article by VAN HOOF consists of general remarks on sleeping sickness in the *T. gambiense* and *G. palpalis* regions based upon researches carried out in Budama, Kavirondo, the Upper Uele and the Semliki Valley.

5. *The Treatment of Sleeping-Sickness by Ingestion of Tryparsamide.* By L. VAN HOOF. [pp. 382–384.]

In this paper VAN HOOF reports upon four patients who were treated by oral administration of tryparsamide. In three of the patients whose lumbar fluid was more or less definitely impaired, the treatment —even with doses of 25 cgm. per kilo—was entirely ineffective. In one recent case with unimpaired spinal fluid, doses of from 5 to 11 cgm. produced apparent cure.

6. Subsidiary Research. *Preventive and Curative Action of "Spirocid" in African Relapsing Fever.* By L. VAN HOOF. pp. 385–388.]

This article, also by VAN HOOF, records observations on the preventive and curative action of "Spirocid" in African relapsing fever. It is concluded that the drug has an undoubted preventive and curative action. Its preventive action is in practice the more important; the curative action seems obviously weaker and slower than that of the arzenobenzols.

VII. **General Recommendations for the Control of Sleeping Sickness in African Dependencies.** By F. K. Kleine, L. van Hoof, and H. L. Duke. [pp. 391-392.]

These are :—

" 1. The movement of natives ought to be controlled.

" This implies :

" (*a*) A census, carried out by the Administration, of all natives.

" (*b*) The institution and employment of an identity book or card for each native, in which can be included a medical passport, to which reference will be made later on.

" (*c*) Delimitation of areas, entry into and departure from which are contingent on the possession by the native of a visa from the medical authorities stating that he is free from trypanosomiasis.

" (*d*) The formulation and promulgation of a law or laws giving force to all these regulations.

" It is desirable, and in French and Belgian territory has been proved practicable and efficacious, that the medical authorities should, in certain circumstances, be endowed with judiciary powers, as far as concerns the enforcing of this legislation.

" (*e*) An international agreement, between the Administrations of all countries in which human trypanosomiasis occurs, about the control of the disease on frontiers ; an agreement similar to those adopted to control epidemic infectious diseases such as plague and smallpox.

" (*f*) The establishment of observation-posts where the examination and control of visas can be carried out.

" 2. The census of infected natives ought to be thorough and complete.

" To ensure this aim there must be :

" (*a*) An adequate control over the movements of natives, as already indicated above.

" (*b*) An adequate medical personnel employing the accepted methods of diagnosis.

" (*c*) A medical passport for every native, on which can be periodically recorded the results of examination for human trypanosomiasis.

" (*d*) Legal means of compelling natives to submit to medical examination and treatment.

" 3. Natives infected with trypanosomiasis ought to be treated.

" Without insisting on the method of treatment, which will vary according to local circumstances, infected natives ought to be compelled to submit to treatment.

" This implies :

" (*a*) If necessary, confinement in a hospital.

" (*b*) Withdrawal of travel permit and medical passport, *pro tem.*

" (*c*) After-treatment, careful record of visits, treatment received, etc.

" This is especially important in the case of natives who come up at intervals for treatment, but who are not confined to hospital.

" 4. The evacuation of heavily infected zones.

" This is an urgency measure, and only to be applied in special cases ; such are epidemic extension in an endemic focus ; impossibility of breaking contact between fly and man ; insufficiency of medical and administrative personnel to carry out prophylactic measures, or of natives to set on foot and maintain sanitary measures.

" Before resorting to this measure, organised concentration of population should be tried in carefully chosen areas, where contact between fly and man can be eliminated or adequately controlled and reduced.

" 5. Clearing measures are generally very costly, and, unless carried out under the control of trained entomologists, are of little permanent benefit. In *palpalis* regions, such measures should be restricted to much-frequented places, and they must be thorough and well-maintained. Otherwise they are useless."

W. Yorke.

ENZER (A. J.). **A Sleeping Sickness Survey.**—*Kenya & East African Med. Jl.* 1928. Mar. Vol. 4. No. 12. pp. 386–390.

Commencing in August, 1926, a survey was made of the lakeshore Kavirondo population of Victoria Nyanza with a view to ascertaining the present position as regards sleeping sickness. The task was formidable and over 209,000 people were seen: some account is given of the difficulties encountered. The preliminary examination made was gland palpation—usually the cervical, but in some localities the axillary. In suspicious cases gland puncture was performed and the fresh gland juice examined microscopically; this was followed in negative cases by examination of centrifuged citrated blood, and by spinal puncture. In over 80 per cent. of cases with gland enlargement trypanosomes were found in the fresh gland juice at the first examination and in less than 10 minutes' search. Examination of centrifuged blood was unsatisfactory, being negative in many cases in which trypanosomes had been found in the gland juice. Cerebrospinal cell counts of 200 or more were regarded as diagnostic of trypanosomiasis, other diseases producing a high cell count having been first eliminated.

The census was completed in November, 1927, and established several important facts. It proved that an examination on a wholesale scale can be accomplished and exact figures for any disease ascertained. It has shown the exact sites of infection, the easy method of controlling it in the future, and finally Kenya's comparative freedom from the disease. The educational value to the natives was great. In all, 388 cases of sleeping sickness were discovered and of these 109 were found in an area of approximately four square miles with a population of 845. This was the only place where such a high percentage of infection occurs, the other cases being found scattered along the lakeshore.

W. Y.

MURAZ (G.). Résumé de l'action, en Afrique Equatoriale Française, pendant huit ans (1920–1927), d'un secteur de prophylaxie de la maladie du sommeil. [**Eight Years' Experience in French Equatorial Africa of a Sector of Prophylaxis of Sleeping Sickness.**]—*Bull. Soc. Path. Exot.* 1928. Jan. 11 & Feb. 8. Vol. 21. Nos. 1 & 2. pp. 54–65; 141–158. With 3 figs. & 4 charts in text.

I. These papers commence with an attempt to determine the value of the sleeping sickness campaign in Sector III (South of Tchad) since its inception in 1919. A map of the Sector is given showing year by year, and zone by zone, the annual percentage of new contaminations; and also the situation of the two segregation camps, the three "Postes-Filtres" and the 15 villages of free segregation. In centres the patients have been treated methodically and those in the bush have in general received a sufficient number of injections to give them a chance of recovery and to protect the rest of the inhabitants; but on consulting the tallies and records it is found that many of these were insufficiently treated since they were absent at the time of treatment or fled at the approach of the doctor: such are dead.

The number of individuals examined, of those atoxylized and of new cases during the year 1919–1926, is set forth in a table. The fall in the number seen, which is shown in the last two or three years, is due to the establishment of the segregation villages. These have been visited at least once a year and the new cases which have been diagnosed

have received in the villages of "segregation libre" a series of six injections of some arsenical. Information is supplied in a table of the number of persons examined, the number of injections given and the number of new cases seen, at each of the three observation posts, viz., Fort-Archambault, Manda, and Lai-Béhagle.

The end of 1926 has seen practically the conclusion of the new prophylactic programme, which consisted essentially of free segregation during 4 years (three for treatment and one for observation) of the patients diagnosed in the course of one very complete tour annually. The author believes that the segregation camp at Fort-Archambault and the station for treatment at Lai-Béhagle should be maintained for some time longer in order to educate the patients of the villages and make them appreciate the "ségrégation libre." This system is next defined and its advantages discussed in some detail. In 1925 attention was drawn to the remarkable results obtained in the Egyptian Sudan by the organization of village lazarets, and the question arose whether this excellent system should at once be substituted for that of frequent tours and segregation camps. The author thinks not. The segregation camp receives two classes of cases, first those who desire methodical treatment and secondly those who have avoided the medical touring mission. Stress is laid on the latter group. The only prophylaxis hitherto undertaken has consisted in frequent tours, but their frequence in a vast sector is from the point of view of medication quite minimal and the sterilization which results has been estimated at the Pasteur Institute of Brazzaville to be only 17 to 24·5 per cent. The segregation camp plays a necessary rôle in dealing with the fugitives. All who have avoided the medical touring mission are notified and taken by the Administration to Fort-Archambault or to Béhagle, where they receive treatment. The patients in Sector III know that when they are absent at the time of the visit of the medical mission they will be taken to the Centre. Whilst introducing the system of village lazarets the author desires to continue the segregation camps, so that the native learns that he must either undergo treatment at the village of segregation "ségrégation libre" or at the camp of segregation "ségrégation imposée."

The situation of the fifteen villages of "ségrégation libre" in Sector III is given. These villages are distributed in the various portions of the sector and each contains about 250 infected, all of whom are identified by means of a metal tally, a description of which is given. The paper contains a plan of a village lazaret and details of the working of the system.

The next section deals with new facts in the sector in the course of the years 1925–1926. The question whether all the villages on water-courses should at once be moved is discussed in some detail. Two obvious advantages would be decrease in both sleeping sickness and malaria, but the difficulties in the way are very great and in certain cases the procedure is definitely contra-indicated.

Reference is next made to the discovery of a new focus of trypanosomiasis at Tabila in the sub-division of Moundou, Moyen-Logone. The district is difficult to visit and was prospected for the first time in the middle of 1925. The people proved to be veritable savages, and it was almost impossible to deal with them. At Tabila about 11 per cent. of the population was infected; other heavily infected villages were Lolo, Bâ, Laokassi, N'Gouri, and Maïkann.

The author revisited Schoa in the third quarter of 1925 and was surprised to find that the village, which had been removed in 1921, had returned to its original site near the Tandjilé. He re-examined the population and found that whereas in 1920–22 there were 569 infected of 900 examined, in 1925 only 78 were infected out of 501, and none of these were new infections.

An enquiry was made into the birth rate in one of the infected villages (Morongoulaye) with a population of 1,105. The number of living children per woman varied from 0·2 to 2. Information is given in two tables of the coefficient of sterilization resulting from the annual treatment of a series of six injections of atoxyl. In two other tables the condition of the spinal fluid, as regards the number of cells contained, before and after treatment with tryparsamide, is given: these observations confirm the great value of the drug in the second stage of the disease.

After an account of attempts to treat cattle infected with *T. pecaudi*, with Fourneau 309, the author passes to certain general conclusions. In March, 1927, he left to his successor a new scheme of prophylaxis in the south Tchad region. The establishment of 15 trypanosome centres has not been effected without great effort on the part of the administration, of the healthy population, and of the patients themselves. These villages of "ségrégation libre" are an attempt to simplify the prophylactic effort especially with a view to better treatment. The freedom from taxation, the payment of labour, and the maintenance of domestic conditions constitute undeniable essentials for treatment: there result less avoidance of treatment, less deficient treatment and less mortality. A single thorough tour annually of each zone should suffice to ensure a progressive diminution of new infections. The new cases should be sent at once to their appropriate village of "ségrégation libre" and receive methodical treatment during a period of three years.

W. Y.

Revista Médica de Angola. 1927. Jan. No. 5. pp. 1–91. With 12 figs. on 8 plates, 7 maps, 1 plan & 7 figs.—Os trabalhos das missões do sono establicidas nos distritos do Congo e Zaira, em 1923. [**The Work of the Sleeping Sickness Mission in the Zaire and Congo Districts of Portuguese West Africa in 1923.**]

The prevailing fly is *Glossina palpalis* in all the districts and the numbers of individuals infected are high: in Madimba the figure given is 13 per cent., and in Lunda the same, in Buela 11, Cuimba and Luva each 10 per cent., and many were in the second and third stages of the disease.

The measures undertaken for dealing with them were (1) removal of the population from the places heavily infested with tsetse, (2) segregation of chronic cases, (3) treatment with atoxyl of every case showing symptoms. The author is in favour of general administration, but this was not practicable. Camps were instituted where those under treatment could live segregated, but with considerable freedom, and posts were determined upon in central situations where treatment was carried out. Owing to the difficulty of obtaining "Bayer 205" and its price in 1923, atoxyl was largely used. 1 gm. in two doses in 24 hours was given to adults, 0·5 gm. to children over four years of age, and 0·4 gm. to those younger. This amount was

given weekly for ten doses, repeated after a month and so on till all symptoms disappeared, or there were indications of toxic effects of the arsenic. Except for a few mild cases of amblyopia and a dozen or so of amaurosis which recovered when the course was interrupted, the results are recorded as satisfactory. "Bayer 205" was employed in some instances, but though the author was struck with the rapid disappearance of the trypanosomes, he thinks that the nephritis and, in some patients, amblyopia progressing to complete amaurosis militated greatly against its general employment.

Brief notes of 28 cases are given all of whom took "Bayer 205," some after many doses (50 in one patient) of atoxyl. Of these five are stated to have been cured, five were keeping well, but the time was too short to say whether they could be regarded as cured, four were much improved, three were considerably better, eleven died; all of the last were advanced cases with much somnolence, some with fits or paretic symptoms. One improved slightly at first, but died later. In most of the twenty-eight the drug was given in 0·5 gm. doses hypodermically.

Figures are not given of the results in those treated by atoxyl.

H. Harold Scott.

KLEINE (F. K.). Ueber den Erreger der Schlafkrankheit. [**On the Parasite of Sleeping Sickness.**]—*Deut. Med. Woch.* 1928. Mar. 16. Vol. 54. No. 11. pp. 423–424. With 2 text figs. ["Robert Koch" Inst., Berlin.]

In this article Kleine summarizes once again the reasons which cause him to believe that *T. gambiense* and *T. rhodesiense* are the same, and that *T. rhodesiense* and *T. brucei* are distinct species. All the points raised have already received notice in this *Bulletin*.

W. Y.

DUKE (A. Lyndhurst). **On the Effect on the Longevity of** *G. palpalis* **of Trypanosome Infections.**—*Ann. Trop. Med. & Parasit.* 1928. June 12. Vol. 22. No. 1. pp. 25–32.

The author has often been impressed by the frequency with which cyclically infected *G. palpalis* survive to the end of an experiment, i.e., for a period of at least thirty days; and the impression gradually grew that the presence of developing flagellates in the fly's intestine helped to keep the insect in good condition, possibly by aiding in the disposal of the regular and copious meals taken during its working life at the laboratory.

Duke consequently decided to examine the accumulation of experimental data now available at the Entebbe laboratory. In a table details are given relating to transmission experiments with laboratory-bred flies during 1926 and 1927. It is noted that during the first few days of an experiment there is often a relatively heavy mortality, especially when the weather is hot and dry. Some of the newly-hatched flies neglect their first opportunity of feeding and either die of inanition, or lose their stamina and die early in the experiment. In the present argument all flies dying during the first ten days after the first feed on the infected animal are neglected. The conditions prevailing at the laboratory throughout the year are fairly constant, and no attempt was made to correlate the fluctuation in the death

rate with the changes of the weather. It is realized that the data presented are very limited, and that their statistical value cannot be very great. Under the most favourable experimental conditions 20 per cent. of infected flies is an unusually high figure. It is impossible to secure real uniformity in the environment of the experimental flies, and different strains of trypanosomes, or differences in diet, may exert different effects on the vitality of the fly. No notable organic cause of death among the experimental flies was detected. Heavy bacterial infections of the intestine sometimes were seen, but only very rarely in flies infected with trypanosomes. There is no evidence that these bacteria are pathogenic to the fly. Fungal infections, which are always lethal, were very rarely seen.

The author believes that, notwithstanding many possible fallacies, his figures do throw some light on the adaptation of a protozoon to an insect intermediate host; and that the association of trypanosomes of the *brucei* group with tsetse is, biologically speaking, a recent step in the evolution of these parasites.

All experiments that contained five or more infected flies, i.e., 10 per cent. to 12 per cent. of the total number, are summarized in a table. It is interesting to note that in certain of the experiments every infected fly lived for thirty days or longer, and it was these and other similar experiments which caused the impression that the flagellates might be actually beneficial to the fly—an impression which, however, was proved to be untenable from more comprehensive examination of the available data. The table, however, indicates unmistakably that the flagellates are not actually pathogenic to the fly, and that during the first thirty or forty days of the insect's life in captivity little or no disturbance is caused by their presence. In two other tables a comparison is made of the death rate of the uninfected and of the infected flies, but from these nothing very definite can be concluded save that the presence in its intestine of developing forms of the polymorphic trypanosome is not to any noticeable extent injurious to the fly; but, on the other hand, the evidence produced lends no direct support to the author's original impression that the presence of the flagellate infection in its intestine was beneficial to the fly.

W. Y.

LAVIER (G.). Rôle uniformisant de l'hôte vertébré dans la morphologie des trypanosomes du groupe *brucei*. [**Regulating Part played by the Vertebrate Host in the Morphology of Trypanosomes of the Brucei Group.**]—*C. R. Soc. Biol.* 1928. Feb. 24. Vol. 98. No. 7. pp. 520–524. [4 refs.]

Inoculation of a guineapig with the blood of a man or animal naturally infected with a trypanosome belonging to the group *brucei* causes an infection which terminates in death in from 4 to 6 months, whilst in the case of a trypanosome belonging to the group *gambiense* the infection lasts from 12 to 14 months or even more. The principal characteristic of this group of trypanosomes is their polymorphism. This is particularly marked in strains recently isolated and diminishes as time goes on. After an incubation period of 15 days to 5 weeks infection commences by the appearance of long and intermediate forms. A little later the short forms appear. It is during about the second week that the polymorphism is fully manifest. At this period division is so rapid that forms appear which lack a nucleus or a parabasal body.

The former disappear, but the latter are capable of dividing, producing a strain of blepharoplastless individuals. In addition to these forms there appear also others of small size with a free flagellum, and not longer than the typical short form. These small forms are equally affected by the rapidity of division, and one sees amongst them individuals with 2, 3, or 4 nuclei aligned like a chain of sausages in the cytoplasm. This appearance is of only short duration and lasts at the most about 14 days. When the defence of the animal is sufficient to cause fluctuations in the number of trypanosomes the appearance changes rapidly. Forms without a nucleus are no longer encountered, the blepharoplastless forms remain stationary. The division is less rapid and is regular and complete, and the variation in size is less pronounced. Towards the 3rd or 4th months of the infection the polymorphism is greatly reduced in comparison with what it was at the commencement of infection. Reference is made to the fact that strains long retained in European laboratories have lost their polymorphic characteristic and become indistinguishable from *T. evansi* and *T. equiperdum*. In trypanosomes of the *brucei* group, which live successively in an invertebrate and vertebrate host, the latter plays a part in regulating the morphology of the parasite, in that its defensive reaction diminishes the divergent element. Factors tending towards variation are, on the contrary, at work during the phase spent in the invertebrate which offers only a slight protection against the variations of the outside world.

W. Y.

SHIRCORE (J. O.). **Infection with Trypanosomes of the Cerebrospinal Fluid by Lumbar Puncture.** [Correspondence.]—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1928. Feb. 25. Vol. 21. No. 5. p. 434.

The author enquires whether an uninfected cerebrospinal fluid might not be infected by lumbar puncture of a case of sleeping sickness with trypanosomes in the blood. He believes that whenever possible the blood should be sterilized by a drug before lumbar puncture is made. He concludes as follows. "I have not undertaken a very large number of lumbar punctures, but if the experience of a few hundred is any criterion, it appears to me that quite a percentage of sterile cerebrospinal fluids might become infected by these means."

W. Y.

PERUZZI (M.). **Infection with Trypanosomes of the Cerebrospinal Fluid by Lumbar Puncture.** [Correspondence.]—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1928. June 30. Vol. 22. No. 1. pp. 95–96.

Reference is made to the question raised by SHIRCORE (above) concerning the possibility of infecting the spinal fluid by lumbar puncture. The author's researches have shown that there is a relationship between vascular injuries, changes in the cerebrospinal fluid, and the presence of parasites. The choroid plexus is the seat of early and massive extravascular invasion of trypanosomes passing into the cerebrospinal fluid through the epithelium; but the parasites are rapidly destroyed in the fluid, provided the albumin content is not sufficiently increased. In 43 positive monkeys, completely

examined, severe changes in the nervous system were visible; but in these monkeys suboccipital puncture had been performed only a few months earlier. Lumbar puncture may then be dangerous, especially if repeated in patients with *T. rhodesiense* infection, not only from the likelihood that blood may carry trypanosomes into uninfected cerebrospinal fluid, but principally because the blood which escapes into the fluid may increase its albumin content sufficiently to allow of parasites surviving in it.

W. Y.

COBB (W. G.). **Six Early Cases of Trypanosomiasis in Europeans in Northern Nigeria.**—*West African Med. Jl.* Lagos. 1928. Jan. Vol. 1. No. 3. pp. 56–57.

The author has recorded in tabular form signs and symptoms and treatment of six early cases of trypanosomiasis amongst Europeans in Nigeria. He emphasizes the fact that in each case the initial fever was severe and its nature suggested that it was not due to an ordinary attack of malaria. All the cases were treated with "Bayer 205" and all were apparently cured.

W. Y.

CORSON (J. F.). **A Case of Rhodesian Sleeping Sickness in a European, contracted in the Ikoma Sleeping Sickness Area of Tanganyika Territory.**—*Ann. Trop. Med. & Parasit.* 1928. June 12. Vol. 22. No. 1. pp. 17–19.

In this note a medical officer gives an account of his own case. He first encountered tsetse flies (*G. swynnertoni*) on April 24th, 1926. On May 4th and 5th he visited a small native settlement notorious for sleeping sickness and was again attacked by *G. swynnertoni*. Afterwards, until febrile symptoms appeared, he saw no tsetse. Symptoms appeared suddenly on May 22nd, and fever continued, notwithstanding quinine, until May 30th, when a blood film was found to contain from three to five or more trypanosomes per 1-12th inch field. "Bayer 205," 1·0, 0·8, 1·5, 2·0 and 2·0 gm., was given on the 11th, 13th, 18th, 23rd and 28th days of the disease. Symptoms were relieved by the first dose, but fever again developed about a fortnight after the end of the course. There was no albuminuria and inoculation of white rat and a guineapig failed to produce infection. Four short courses of tryparsamide were then administered in July, August, September, and October. No relapses occurred within the observation period of eighteen months. The author remarks that probably the chief point of interest in the case is the fact that the patient was able to remain in the district, and after a brief period of convalescence to continue his work on sleeping sickness.

W. Y.

SAUNDERS (G.). **The Minor Symptomatology of Trypanosomiasis.**—*West African Med. Jl.* Lagos. 1928. Apr. Vol. 1. No. 4. pp. 74–75. [3 refs.]

Among the 46 cases of trypanosomiasis seen by the author during the past three years, certain minor manifestations occurred with some frequency. These were gingivitis and abnormalities of nutrition,

particularly early corpulence, which is possibly due to initial lethargy. It was observed that frothy vomiting, tenderness of the soles, localized transient oedema, and urticaria may occur after intravenous injections of "Bayer 205."

W. Y.

CHAGAS (Carlos). A forma cardiaca da trypanosomiase americana. [**The Cardiac Form of Chagas's Disease.**]—*Arch. Brasileiros de Med.* 1928. Jan. Vol. 18. No. 1. pp. 46–56.

Professor Chagas describes clearly the symptoms produced by the lesions and offers an explanation of their origin. In the acute stage of infection there is an intense and diffuse myocarditis in which proceed side by side mechanical and toxic destruction of the muscle fibres, and abundant infiltration of the interstitial tissue, particularly by macrophage plasma cells and lymphocytes. There is no arterio-sclerosis, no involvement of the valves; the cavities are dilated without any accompanying hypertrophy of the walls. The clinical picture is very distinct: an enlarged heart, sometimes to the degree of *cor bovinum*, with persistent arhythmia, and oedema which is slight only if present at all, and a low arterial tension. The arhythmia is due to alteration of conductivity, to partial heart-block in the early stages, complete in the later. At first there are spaced extra-systoles, indicative of the commencement of the inflammatory process in the myocardium, increasing in frequency with aggravation of the myocarditis. Thereafter, according to the sites of the lesions, anomalies of rhythm may be due to either the excitability of the auricular muscle attaining a high degree leading to a final rhythm of tachysystole and fibrillation, or, if the lesions are chiefly in the automatic centres, to progressive functional defect and a permanent bradycardia.

H. Harold Scott.

i. CHAGAS (Evandro). Sobre algumas perturbações curiosas do rythmo do coração na Trypanosomiase Americana. [**Curious Disturbances of Cardiac Rhythm in American Trypanosomiasis.**]—*Folha Med.* 1928. May 5. Vol. 9. No. 13. pp. 149–153. With 10 text figs. ["Oswaldo Cruz" Hosp. & Inst., Rio de Janeiro.]

ii. ——. Sobre algumas perturbações curiosas do rythmo do coração na Trypanosomiase Americana (3a observação).—*Ibid.* June 5. No. 16. pp. 187–189. With 7 figs.

iii. ——. Sobre algumas perturbações curiosas do rythmo do coração na Trypanosomiase Americana (4a observação).—*Ibid.* June 15. No. 17. pp. 201–202. With 6 text figs.

i. The noteworthy point in the two cases here detailed is not merely the arhythmia itself, but the fact that more than one type of arhythmia was observed in each case. Thus, the first exhibited prolonged periods of bradycardia with pulsus bigeminus, at other times irregularity like that of complete arhythmia, sinus arhythmia, auricular fibrillation, and, again, that of extrasystoles. The various disturbances are represented by sphygmographic and electrocardiographic tracings which are explained in detail in the text. There appeared to be complete dissociation between the auricular and ventricular rhythms, and, as it were, multiple fresh focal stimuli at work. The heart was increased in size.

In the second, a man of 30 years, there was also cardiac enlargement, the pulse was regular, 40 per minute, but the cardiograph showed a regular ventricular rhythm of 45, with a slow and irregular auricular rhythm.

After a few days, though the ventricular rate remained the same, the auricular beat became vastly accelerated, 240 per minute. Neither atropin nor adrenalin subcutaneously had any effect, but inhalation of amyl nitrite profoundly modified the tracings; these revealed numerous extra-systoles of the right ventricle, while the auricular beat, though still irregular, became slower.

A probable, at least possible, explanation given is that there were widespread lesions of the auricular musculature with the development of new centres of excitability, leading first to tachycardia and later to auricular fibrillation.

ii. The author places another case of this complication on record; as in the former the irregularities of rhythm are very great and change rapidly, even in the course of 24 hours. They are ascribed to the temporary establishment of new centres of excitability. Several pulse-tracings are reproduced from this case, but they are too reduced to convey much useful information.

iii. The patient was a man of 41 years presenting marked cardiac irregularity with dilatation but no adventitious sounds. The symptoms were similar to those previously noted, but this patient on sitting up to take food died suddenly and a post-mortem examination was held. The heart was greatly dilated but without hypertrophy of the walls. Aggregations of "trypanosome cysts" were seen under the microscope and an intense cellular infiltration of the auricular walls and of the Keith-Flack node. The ventricular walls also showed infiltration, together with interstitial and parenchymatous myocarditis. [Though these findings may account for the irregularity of rhythm, they do not explain the sudden changes of beat and rhythm, occurring from day to day, as have been recorded in the clinical descriptions of these cases.]

H. Harold Scott.

VAN DEN BRANDEN (F.). L'emploi de la tryparsamide dans le traitement de la trypanosomiase humaine. Préface. [**Employment of Tryparsamide in the Treatment of Human Trypanosomiasis. Preface.**]—*Ann. Soc. Belge de Méd. Trop.* 1927. Dec. Vol. 7. No. 3. pp. 211–214.

This is a preface introducing the following eight papers on the use of tryparsamide in human trypanosomiasis. Tryparsamide is the sodium salt of N-phenylglycinamide-p-arsenic acid. It is a white crystalline powder, odourless, readily soluble in water and stable under ordinary conditions. The dose for an adult is 2 to 3 gm., and for a child ·5 to 1 gm. according to its age. The author favours weekly doses of 2 gm. in the adult, because such doses give the same good results as large and more frequent doses, and because they reduce the ocular disturbance to a minimum. In patients of the first stage a total dosage of 20 to 40 gm. suffices, as a rule, to produce a cure. In chronic patients it is necessary to give 50 to 100 gm. Solutions should be prepared fresh, 2 to 3 gm. being dissolved in 10 cc. of cold sterile water. Such solutions should be clear, but they had better be filtered through sterile filter paper to remove any foreign body; any turbidity should cause the rejection of the solution. Boiling should be avoided, as it may give rise to decomposition and produce substances more toxic and less efficacious than tryparsamide. The drug is given intramuscularly or, more usually, intravenously.

Reference is made to "Tryponarsyl Meurice," a product of Belgian manufacture which has the same chemical formula as tryparsamide. The action of this drug in chronic human trypanosomiasis is on all points comparable with that of tryparsamide.

i. MARUGO. Note au sujet du traitement de la trypanosomiase humaine par la tryparsamide (A 63).—*Ibid.* pp. 215–247.

The author set out to answer the following questions :—

1. What is the action of tryparsamide in cases curable with drugs usually employed ; are there any differences and which is to be preferred ?

2. What is the action of tryparsamide in cases not curable with other drugs ; are the differences appreciable and can such cases be actually cured ?

3. What are the toxic actions of the drug ?

4. Should it be used in conjunction with other drugs ?

The patients selected for treatment fall into five groups. A. Patients in the last stage of the disease with profoundly altered spinal fluid and who had not been treated previously. B. Similar cases who had been unsuccessfully treated with other drugs. C. Cases in which the spina fluid is but slightly altered and who may or may not have been treated previously. D. Recent cases with parasites in the blood or gland juice. E. Cases with very greatly altered spinal fluid who may or may not have received previous treatment and who exhibited very varied nervous manifestations.

The author's first endeavour was to ascertain the best dosage, and the most suitable intervals between the injections. He commenced with weekly injections of 1 gm. and as these were well tolerated decided to increase each dose by 0·5 gm. By this means he was able to reach doses as high as 7 gm. in an adult male, 6 gm. in an adult female, 4 gm. in a child and 3 gm. in an infant, in good general condition, without having to deplore any accidents. But as such massive doses did not give better results than smaller ones they were not used habitually and the author finally decided that the best quantity to be given at an injection was as follows: For adult males and females in good general condition 3 gm., and if the general condition was not very good 2 to 3 gm. ; and for children according to the age and condition 0·5 to 2 gm. The total quantity given in a single series of injections was as much as 60 to 80 gm., but, as a rule, it was not necessary to exceed 50 gm. for adults and proportionately less for children.

By this method the author has never had any serious toxic effects. The visual disturbances resulting from the use of tryparsamide only were sometimes rather grave, but they disappeared completely on cessation of treatment. In certain patients who came under treatment very late and had been previously treated with other drugs, visual disturbances were very pronounced and even total blindness sometimes occurred.

Those patients who exhibited pronounced nervous symptoms almost always showed rapid and considerable improvement as the result of treatment, whilst in cases of moderate intensity the benefit obtained was even more marked and constant. Certain information is given regarding the amount of the drug administered and the condition of the spinal fluid in respect of 131 cases, and as a result of his observations of these cases, the author draws the following conclusions :—

1. The action of tryparsamide whether American or Belgian has proved to be rapid, durable, constant, and definitely superior to that of any known drug. Relapses or incomplete cures are always due to extraneous causes, such as insufficient dosage, irregularity of the injections, and difficulties due to the patient.

2. Some very grave cases have not received much benefit, possibly owing to intolerance of the drug, or to the fact that the disease was so advanced that the organic reaction and resistance was nil.

3. Toxic reactions, either acute or chronic, are negligible. Cases of total blindness which occurred after treatment with tryparsamide have always been the subject of previous arsenical treatment.

4. Tryparsamide is, in the author's experience, definitely superior to all other medicaments known and employed in sleeping sickness.

ii. VAN DEN BRANDEN (F.). Essais de traitement de la trypanosomiase humaine chronique par la "tryparsamide."—*Ibid.* pp. 249–271. [3 refs.]

The author advocates the administration of tryparsamide in weekly doses of 2 gm. for adults, because the results obtained with such doses are similar to those obtained with larger doses, and the ocular troubles are reduced to a minimum. The total amount which should be administered varies from 50 to 100 gm. or more. The author remarks that prolonged treatment of a number of chronic cases lasting for 1½ to 2 years with soamin and emetic has resulted in permanent cure in some cases, but the period of treatment is more prolonged than that of tryparsamide and the results obtained are more uncertain.

A summary is given of the result of treating sixty-one chronic cases with tryparsamide. The results obtained were as follows :—

A. *Patients with trypanosomes in the spinal fluid.*
In 5 of 17 the spinal fluid has become normal.

B. *Lymphocytosis in spinal fluid not exceeding* 50 *per cmm.*
In 5 of 7 the spinal fluid became normal.

C. *Lymphocytosis in spinal fluid between* 50 *and* 100 *per cmm.*
In 4 of 9 the spinal fluid became normal.

D. *Lymphocytosis in spinal fluid between* 100 *and* 200 *per cmm.*
In 3 of 12 the spinal fluid has become normal.

E. *Lymphocytosis in spinal fluid between* 200 *and* 500 *per cmm.*
In 4 of 16 the spinal fluid became normal.

F. *Lymphocytosis in spinal fluid exceeding* 500 *per cmm.*
In 4 of 8 the spinal fluid became normal.

In 25 of 61 cases of chronic trypanosomiasis treated by tryparsamide the spinal fluid became normal. This compares most favourably with the results obtained by prolonged courses of soamin and emetic. In only 17 per cent. of such cases the spinal fluid became normal. Details of the 61 cases are given in a series of tables.

iii. KELLERSBERGER (E. R.). **Report on One Hundred Cases of Sleeping Sickness treated with Tryparsamide.**—*Ibid.* pp. 273–291. [12 refs.]

During the last two years the hospital of the American Presbyterian Congo Mission at Katanga has received one thousand cases of sleeping sickness. Patients came to the hospital from distances of over 150 miles and a regular camp for sleeping sickness cases near the hospital has made it possible to treat and control and follow most of the cases closely. All the patients came voluntarily and the results have been extremely satisfactory. The drugs used were atoxyl, soamin, "Bayer 205," and tryparsamide. The present report deals with the results

obtained with tryparsamide. The cases chosen have been divided into four classes :—

1. Early cases.
2. Cases with slight or moderate changes in the spinal fluid.
3. Cases with marked spinal fluid changes and great clinical changes.
4. Advanced cases previously unsuccessfully treated by other drugs.

On entry to hospital each patient was weighed, a thick drop blood preparation was taken, gland puncture made, and initial lumbar puncture done. The highest percentage (75 per cent.) of diagnoses was made by gland puncture ; 15 per cent. were made by examination of the thick drop of blood, and a certain number of advanced cases were only diagnosed by lumbar puncture. The doses vary in each case ; the more advanced the disease the smaller the dose given at first. In general an average of 5 cgm. per kilo. was found to be a good working dose. This was varied as each case demanded. The injections were given once weekly for 8 to 10 weeks, when a second lumbar puncture was done and the weight again noted. After a rest of two to three months, a second lumbar puncture was performed ; if this was normal a fourth lumbar puncture was made three months later, and if this was also normal the patient was discharged. The weight curve was a fine index for progress. Almost every one of the one hundred cases treated in this paper gained considerably in weight. In all of the cases the method seemed to result in cure, or, in much advanced cases, in complete arrest of the disease. In the far advanced cases a second course of treatment is advised after several months, even if the cell count is normal or almost so. Untoward results were very rare.

In a series of four tables information is given regarding the results obtained of the treatment of one hundred cases. The tables show the amount of drug given, the period over which the course of treatment continued, the weight immediately before and after treatment, and four months later ; and the condition of the spinal fluid before and immediately after treatment, and again three or four months, and eight and nine months after cessation of treatment.

The following are the conclusions :—

"Tryparsamide is a very efficient trypanocide.

"It is especially useful in advanced cases, and almost universally brings the spinal fluid back to normal in a comparatively short time.

"It causes very marked clinical improvement.

"Patients have remained well, gained much weight, and been apparently cured for more than a year after treatment.

"It has very few bad after-effects, and is easily given.

"It can be given either intravenously, intramuscularly, or subcutaneously with no reaction of any importance.

"Blindness, though a danger, is not a frequent complication, and can be avoided.

"It is a quicker and easier, less painful method than atoxyl, and therefore cheaper in the end.

"It has successfully been given in the field by trained native workers.

"It cures where other drugs have failed.

"It is the most efficient drug so far available."

iv. Lopes. Résultats du traitement de la trypanose humaine par la tryparsamide.—*Ibid.* pp. 293–295.

Information is given concerning twenty-five chronic cases of trypanosomiasis previously treated with atoxyl, and then subjected to a

course of tryparsamide. In twelve of these the leucocyte formula of the spinal fluid had returned to normal. In eight the lymphocytosis diminished and in five it had increased. The patients received quantities of the drugs varying from 23 to 118 gm.

v. INFANTE. Essais de traitement de la maladie du sommeil par la tryparsamide.—*Ibid.* pp. 297–301.

The author presents a couple of tables showing the effect of tryparsamide in the treatment of 52 cases of sleeping sickness, all of which exhibit changes in the spinal fluid. The cases were divided into two groups; the first, consisting of 29 cases, had been previously treated with atoxyl or soamin, and the second, consisting of 23, had had no previous treatment.

The conclusions are :—

1. Tryparsamide is very efficacious in the treatment of sleeping sickness, even in very grave cases.
2. The single course of 50 gm. for an adult appears to cure 52 per cent. and to ameliorate greatly 48 per cent. of cases of sleeping sickness in the second stage.
3. The accidents resulting from such a course of treatment are insignificant; the ocular troubles are rare and not severe.

vi. DAVID. Le traitement de la trypanosomiase humaine par la tryparsamide.—*Ibid.* pp. 303–309.

Information is given regarding the treatment of twenty cases of sleeping sickness with tryparsamide. In most of the cases the doses given were insufficient.

vii. WILLE; WALLON (M.). Essais de traitement. [**Treatment Trials.**]—*Ibid.* pp. 311–318. [8 refs.]

These papers simply record in tabular form a number of cases of sleeping sickness treated by tryparsamide.

viii. TROLLI (G.). Le traitement de la trypanose humaine par la tryparsamide. (Revue générale.) [**A Review.**]—*Ibid.* pp. 319–336. [22 refs.]

This paper is a general review of the work of the other authors on the treatment of sleeping sickness by tryparsamide. It is concluded in this survey that tryparsamide is a trypanocidal drug of the greatest value, both from the prophylactic and curative points of view. The drug is of great moral value to the natives, who witness veritable resurrections, and are beginning to have as much confidence in the treatment of sleeping sickness as they have in that of yaws and syphilis. Even very advanced cases may be cured and the accidents which from time to time occur are not serious when the drug is properly administered. The optimum dose is 0·03 gm. per kilo. given weekly to patients whose spinal fluid is changed. Other patients can tolerate as much as 0·05 gm. per kilo. Patients in the first stage of the disease should receive a total dosage of from 25 to 30 gm., the others between 50 or 80 gm., or more.

W. Y.

KEEVILL (Arthur J.). *Trypanosoma rhodesiense* **Infection treated with "Bayer 205" or "Fourneau 309."**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1928. June 30. Vol. 22. No. 1. pp. 83–84. [Moravian Mission, Sikonge, Tabora, Tanganyika Territory.]

Amongst the cases of sleeping sickness diagnosed and treated during 1925, six are of interest in view of their reaction to "Bayer 205." All were infected with *T. rhodesiense*, and all had trypanosomes in the cerebro-spinal fluid. Details are given in the following table :—

Tabora Case No.	Sex/Age	Duration of Symptoms.	Treatment.			Cerebrospinal Fluid.			Present Condition.
			Date.	Drug.	Dose	Date.	Cells.	Trypan's.	
72	M. 40	3 days	28.10.25	B	1g.	26.10.26	90	Present	
			30.10.25	B	2g.	18.12.25	40	Nil	
			7.11.25	B	2g.	13. 1.28		Normal	Excellent
80	M. 20	8 days	14.11.25	B	1g.	14.11.25	30	Present	
			16.11.25	B	2g.	15.12.25	10	Nil	
			25.11.25	B	2g.	14. 1.28	Puncture failed		
						28. 2.28	Puncture failed		Excellent
85	M. 50	1 month?	30.11.25	B	1g.	29.11.25	10	30	
			2.12.25	B	2g.	16.12.25		Normal	
			9.12.25	B	2g.	6. 7.27		Normal	
						14. 1.28		Normal	Excellent
86	M. 50	14 days	7.12.25	F.	1g.	7.12.25	90	Present	
			9.12.25	F.	2g.	21.12.25	30	Nil	
			16.12.25	F	2g.	15. 7.26		Normal	
						3.11.27		Normal	Excellent
91	M. 50	11 days	11.12.25	B	1g.	11.12.25	R.B.C.	Present	
			14.12.25	B	2g.	21.12.25	20	Nil	
			19.12.25	B	2g.	6. 1.28		Normal	Excellent
97	F. 25	10 days	26.12.25	B	1g.	26.12.25	80	60	
			28.12.25	B	2g.	18.11.26		Normal	
						4. 3.28		Normal	Excellent

B="Bayer 205." F="Fourneau 309."

W. Y.

SAUNDERS (G. F. T.). **Intrathecal Bayer 205.**—*West African Med. Jl.* Lagos. 1928. Jan. Vol. 1. No. 3. pp. 44–46. [1 ref.]

Details are given of an attempt to treat five cases of trypanosomiasis by intrathecal and intravenous injections of "Bayer 205." The results appeared to be unsatisfactory and the following summary is given :—

"1. Five cases of Trypanosomiasis have been treated with small doses of very dilute "Bayer 205" intrathecally.

"2. Alarming symptoms may follow even these small doses.

"3. Advanced cases are not benefited.

"4. One acute case with definite cerebral symptoms but only 4 cells per cmm., C.S.F., appears to have been cured."

W. Y.

BRUYNOGHE (R.) & DUBOIS (A.). Action *in vitro* de divers alcaloides et produits chimiothérapiques sur des trypanosomes. [**Action in vitro of Alkaloids and Chemotherapeutic Products upon Trypanosomes.**]—*C.R. Soc. Biol.* 1928. May 4. Vol. 98. No. 14. pp. 1249–1250. [Bact. Inst., Louvain.]

After referring to the fact that certain drugs, such as atoxyl, are inactive *in vitro* and active *in vivo*, while emetic is equally active *in vitro* and *in vivo*, and other antiseptics are active *in vitro*, but inactive *in vivo*, the authors describe a number of experiments with various alkaloids devised with a view to ascertaining whether trypanosomes, which had been subjected to the action of these drugs *in vitro* for various periods, and are still motile, are capable of infecting animals. There was some slight discrepancy in their results, but the main fact appears to be that when the trypanosomes are still motile they are capable of infecting.

Further experiments were performed with trypaflavin and sodium emetic. These two drugs act in very dilute concentrations and the motility of the trypanosomes is soon affected. On two occasions the parasites were found to be still motile after being subjected to a solution of 1 in 100,000 of emetic for three hours and one and a-half hours, respectively, and on two occasions the same result was obtained with trypaflavin in the same dilution and for the same periods. No infection was obtained in mice injected with these trypanosomes. In other experiments, however, the results were contradictory.

The authors then turned their attention to drugs inactive *in vitro*, but very active *in vivo*, e.g., tryponarsyl Meurice and "Fourneau 309." Trypanosomes remained motile in 1 per cent. solution of these drugs for many hours and the washed parasites infected animals.

W. Y.

KLIGLER (I. J.). **Susceptibility and Resistance to Trypanosome Infections. IV.—The Duration, Specificity and Hereditary Transmission of Resistance acquired after Cure with "Bayer 205" (Germanin).**—*Ann. Trop. Med. & Parasit.* 1928. June 12. Vol. 22. No. 1. pp. 21–23. [2 refs.] [Dept. Hyg. Hebrew Univ., Jerusalem.]

The object of this paper is to report experiments bearing on the specificity of the resistance exhibited by animals cured with "Bayer 205" and on its intra-uterine transmissibility from mother to offspring. Guineapigs infected with *T. evansi* were, after the infection had lasted several weeks, cured with "Bayer 205." After varying intervals the cured animals were re-infected, some with the homologous strain, and others with *T. gambiense* and *T. rhodesiense*, respectively. In a few instances it was possible to test the resistance of offspring from "Bayer 205" treated mothers born at a time when the mothers were fully refractory to re-infection. The young guineapigs were always infected with the homologous strains. As a result of his work, the author concludes that animals infected with *T. evansi* and treated with "Bayer" are as refractory to re-infection with *T. gambiense* as with the homologous strain and for approximately the same period. The converse is also the case. Separation of species by this means is not feasible. The refractoriness or resistance to infection is not transmitted from mother to offspring.

W. Y.

MUTERMILCH (S.) & SALAMON (E.). L'immunité méningée au cours du nagana expérimental du lapin. [**Meningeal Immunity in Experimental Nagana of the Rabbit.**]—*C.R. Soc. Biol.* 1928. May 25. Vol. 98. No. 17. pp. 1512–1514. [3 refs.] [Pasteur Inst., Paris.]

Reference is made to the previous papers of the authors on this subject and also to that of LEVADITI and DELORME [*ante*, p. 352 and p. 350]. Their present work confirms in the main that of LEVADITI and DELORME. It was found that *T. brucei* injected intraperitoneally in rabbits could traverse the vasculo-meningeal barrier and reach the cerebrospinal fluid where their presence could be demonstrated by the inoculation of the fluid into mice. Of 57 inoculations made 14 gave a positive result. The trypanosomes found in the spinal fluid during relapses are identical with those in the blood; that is, they are resistant to anti-body. The cerebro-spinal fluid of animals inoculated intraperitoneally is poor in cells and does not contain antibody, although this may be plentiful in the serum. Trypanosomes inoculated subdurally into normal rabbits rapidly invade the circulation and remain in the spinal fluid for 4 to 5 days; then they disappear suddenly. The specific antibody appears in great quantity in the blood, but only in small amount in the cerebrospinal fluid. It was found to be impossible to enrich the antibody in the spinal fluid, and the author believes that what is present comes from the circulation, owing to the marked meningeal reaction provoked by the parasites.

W. Y.

LEVADITI (C.) & DELORME (M.). Mécanisme des accidents nerveux tardifs des trypanosomiases. [**Mechanism of the Late Nervous Symptoms of Trypanosomiasis.**]—*C.R. Soc. Biol.* 1928. July 6. Vol. 99. No. 23. pp. 379–381. [4 refs.]

It has been shown in a previous communication (*ante*, p. 350) that subarachnoid injections into rabbits provoke the following reactions: (1) An infection of the subarachnoid cavity lasting 4 to 6 days; this local infection is followed by invasion of the circulation. (2) A general refractory condition in which the subarachnoid cavity also participates.

The authors have enquired whether subarachnoid injection of dead trypanosomes, subcutaneously or intraperitoneally, provokes the appearance of trypanocidal antibodies. An account of the technique used is given. Washed trypanosomes from a rat suspended in normal saline were killed by heating to 56° C. for an hour. Nine rabbits were given one or more intrarachnoid injections of 0·4 cc. of the sterilized trypanosome suspension (three animals received one injection, and six received three injections at a few days interval). After intervals varying from 5 to 33 days from the last inoculation, the animals were tested by intrarachnoid injections of living trypanosomes. In all cases the prepared animals reacted as the controls and it appears from this work that:—

(1) The repeated inoculation of dead trypanosomes into the subarachnoid cavity produces neither general immunity nor a condition of local resistance.

(2) The neuro-immunity only appears as the result of a trypanosome infection of the blood and of the subarachnoid cavity.

(3) The antigen of the dead trypanosomes does not play any part in the creation of a refractory state of the nervous system and its envelopes.

W. Y.

i. KOKAWA (Hotsuka). Immunitätsforschung über die experimentelle Trypanosomiasis. (I. Mitteilung.) Experimentelle Studien über die Agglomeration. [**Immunity Investigations on Experimental Trypanosomiasis. Experimental Studies on Agglomeration.**]—*Fukuoka-Ikwadaigaku-Zasshi.* (*Fukuoka Acta Med.*) 1927. Aug. Vol. 20. No. 8. German summary pp. 58–59. [In Japanese.] [Bact. Inst., Med. Faculty, Imperial Kiushu Univ., Fukuoka, Japan.]

ii. ——. Die Immunitätsforschung bei experimenteller Trypanosomiasis. (II. Mitteilung.) Ueber die Trypanolyse und ihren Mechanismus. [**On Trypanolysis and its Mechanism.**]—*Ibid.* 1928. Jan. Vol. 21. No. 1. German summary pp. 1–3. [In Japanese.]

iii. ——. Die Immunitätsforschung bei experimenteller Trypanosomiasis. (III. Mitteilung.) Studien ueber Trypanosomenanaphylaxie. [**Studies on Trypanosome Anaphylaxis.**]—*Ibid.* 1928. Feb. Vol. 21. No. 2. German summary pp. 18–19. [In Japanese.]

i. In his experimental studies on agglomeratinins, the author has used *T. lewisi*, *T. equiperdum*, *T. gambiense*, and also their serum-fast strains. It was found that the serum of experimental animals could be made capable of producing agglomeration either by infection or by injection of dead trypanosomes. The agglomerating substance can be absorbed by living trypanosomes, and from them the agglomeratinin can be obtained pure. The resistance of this substance to various physical and chemical conditions was determined; it is filtrable. It is stated that the agglomeratinin passes from the mother to the foetus, and that it is also found in the milk.

ii. The trypanocidal action of infected serum is two-fold; it partly acts through defective nutrition, and partly through trypanolysis. For the latter a combination of antigen and antibody and complement is necessary. The morphological changes which occur in trypanolysis are described. The trypanolytic antibody (trypanolysin) resists heat and cold and bacterial contamination, but is damaged by sunlight and a mercury quartz lamp. It is filtrable but not dialysable. The trypanolysin is absorbed by living trypanosomes at 0° C., but set free again by warming for half an hour at 50° C. Trypanolysis occurs only at body temperatures and not at 0° C., because the complement is not anchored at low temperatures. As in the case of haemolytic complement the trypanolytic complement consists of three fractions.

iii. In this paper the author describes certain experiments on anaphylaxis with the same three strains of trypanosomes. A guineapig can be made anaphylactic by a small injection of trypanosome protein and shows on injection of a large dose five weeks later typical, severe reaction. The serum of rabbits treated several times with trypanosome protein, or injected with living trypanosomes, can make guineapigs anaphylactic. The intravenous injection into guineapigs of a mixture of trypanosome protein and antisera prevents the development of a fatal shock. It is possible by means of the antigen-antibody mixture experiments to differentiate between *T. lewisi* and the pathogenic trypanosomes, but not between *T. gambiense* and *T. equiperdum.* If the mixture of antigen and antibody be centrifuged, it is found that the sediment produces typical shock, whilst the supernatant fluid

produces very slight symptoms. The surviving guineapigs are not susceptible on further injections. If a definite dose of trypanosomes is mixed with fresh normal guineapig serum and allowed to stand for two hours in the incubator "trypanosome anaphylatoxin" is produced *in vitro*. The trypanosome anaphylaxis in guineapigs is accompanied by marked decrease in the coagulability of the blood, decrease in the leucocytes, changes of temperature and decrease of complement. The specific gravity of the lungs is, owing to distension, very much lessened. The anaphylactogen of trypanosome proteid is hardly damaged by drying, shaking, or cold, but is destroyed by heat, sunlight, artificial sunlight, and acids and alkalies. It is to some extent filtrable. The anaphylactic antibody behaves in a very similar way.

W. Y.

ZAVAGLI (V.). Influence des bactéries et des spirochètes tués vis-à-vis du nagana expérimental. [**Influence of Bacteria and Killed Spirochaetes on Experimental Nagana.**]—*C.R. Soc. Biol.* 1928. June 29. Vol. 99. No. 22. pp. 307–309. [11 refs.] [Pasteur Inst., Paris.]

The author refers to a number of papers dealing with the question whether an antagonism exists between trypanosome infections and infections due to spirochaetes and bacteria. He points out that the conclusions reached were usually indefinite and sometimes more or less contradictory. In his experiments, Zavagli examined the effect on the course of the *T. brucei* infection in mice of injections of 2,500 millions of various bacteria, streptococcus, pneumococcus, meningococcus, and *Ps. pyocyanea* killed by minimal temperatures; and also 0·5 cc. of a culture of *Leptospira icterohaemorrhagiae* killed by a temperature of 54° C. Experiments showed that the dead bacteria did not exercise any inhibitory action on the trypanosome infection. The spirochaetes, if alive, appeared to retard the evolution of the trypanosome infection, but when they were dead they had no action.

W. Y.

ZAVAGLI (V.). Recherches expérimentales sur l'antagonisme entre le *Bacillus anthracis* atténué et *Trypanosoma brucei*. [**Experiments on the Antagonism between** *B. anthracis* and *T. brucei*.]—*C.R. Soc. Biol.* 1928. June 29. Vol. 99. No. 22. pp. 310–312. [5 refs.] [Pasteur Inst., Paris.]

The author refers to certain contradictory observations which have been published concerning the antagonistic action of *Bacillus anthracis* against trypanosomes, and in order to clear up the matter he has undertaken the experiments described in this paper. The strain of *B. anthracis* used killed mice in three days. The trypanosome employed was *T. brucei*. It was found that a marked antagonism existed between the two species. According to the dose of the one or the other given either the trypanosomes or the bacteria predominated, but in all cases the morbid process was modified. The two germs were never found in the blood at the same time. In almost all cases where the two organisms were injected in a mixture, the conflict between them ended to the advantage of *B. anthracis*, but its appearance in the blood was, as a rule, delayed. In two cases neither bacteria nor trypanosomes were found in the blood. In mice in which the bacteria were injected the

day after the inoculation of trypanosomes, the *B. anthracis* was eliminated and the development of the trypanosomes sometimes retarded. The mice, which died of trypanosomiasis, were examined for *B. anthracis* twenty-four hours after death by inoculation of the blood or spleen into healthy mice. Sometimes the result was negative and sometimes the infection resulting was very slightly virulent.

W. Y.

WENYON (C. M.). **The Loss of the Parabasal Body in Trypanosomes.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1928. June 30. Vol. 22. No. 1. pp. 85–87. [9 refs.] [Wellcome Bureau of Scientific Research, London.]

For many years it has been known that if rats infected with *T. brucei*, or other trypanosomes, are treated with oxazine or acridine there appears in the blood a certain number of trypanosomes which have no parabasal body (" ablepharoplastic "). By keeping the animals saturated with the drug, it is possible to obtain races which are completely and permanently " ablepharoplastic." In nature such a condition is known to occur only in the case of *T. equinum.* LAVIER has drawn attention to the fact that in certain strains of *T. gambiense, T. rhodesiense*, and *T. brucei*, varying proportions (0·5 to 10 per cent.) of the trypanosomes were " ablepharoplastic " [*ante*, p. 358]. Wenyon has recently been able to confirm LAVIER's observations.

During 1927, the author sent to KEILIN a series of blood films including some of a strain of *T. evansi* (*T. marocanum*) isolated by VELU in 1922, from a horse, and maintained by the author in rats and guineapigs, chiefly the latter. KEILIN remarked in a letter that the trypanosomes in the films of *T. evansi* appeared to be " ablepharoplastic " ; an observation which was quickly confirmed by Wenyon. No change took place on subsequent passage of the strain through rats, and it is evident that in the course of its maintenance in laboratory animals the parasite had acquired the characters of *T. equinum*, 100 per cent. of the trypanosomes being " ablepharoplastic." It is not known when the change took place, but it was more than a year previously ; the strain has not altered in virulence and it has never been used for the testing of drugs. It is clear, therefore, that the condition has arisen spontaneously. Wenyon briefly discusses various hypotheses which may possibly explain the phenomenon.

W. Y.

LAVIER (G.). Existence de formes naturellement " ablépharoplastiques " chez *Trypanosoma evansi* et *Trypanosoma equiperdum*. [**Blepharoplastless Forms in Nature of** *T. evansi* **and** *T. equiperdum*.]—*C.R. Soc. Biol.* 1928. May 18. Vol. 98. No. 15. pp. 1320–1321. [1 ref.] [Parasit. Lab., Faculty of Med., Paris.]

The author has succeeded in finding individuals without a parabasal body (blepharoplastless) in a strain of *T. equiperdum* and in four strains of *T. evansi*. The proportion of these forms present varied in the different strains from 0·4 to 8·0 per cent. These figures are approximately the same as those obtained in the case of various strains of trypanosomes of the *brucei* group, and the author believes indicate the close relation of the species.

W. Y.

SAITO (Masayuki). Cytologische Studien über Trypanosomen, bsd. über die Einwirkung von verschiedenen Heilmitteln, Röntgen- und ultra-violetten Strahlen auf Trypanosomen. [**Cytological Studies on Trypanosomes, particularly the Action of Various Drugs, and Röntgen and Ultra-Violet Rays.**]—*Fukuoka Ikwadaigaku-Zasshi.* (*Fukuoka Acta Med.*) 1927. July. Vol. 20. No. 7. German summary pp. 52–54. [In Japanese.]

The division of the nucleus of trypanosomes is by a process of mitosis. Röntgen rays had no effect on the trypanosomes. Ultra-violet rays were active *in vitro*, the trypanosomes becoming motionless in two to three hours. Human serum had a definite trypanocidal action *in vivo*. In contrast to previous workers, the author states that human serum has a definite action *in vitro*. A strain of *T. gambiense*, which had been preserved in mice for years, was influenced by human serum. The trypanocidal substance was found to be decreased in the placental blood of pregnant women, and in individuals with disease of the liver and icterus. Pleural and peritoneal fluids contained trypanocidal substance. The active substance is in the euglobulin- and pseudo-globulin- fractions, and not in the fibrinoglobulin- and albumen-fractions. If human serum is injected into animal organisms when secretion of trypanocidal substance from leucocytes is taking place, the trypanocidal action of the human serum is still more powerful. The trypanocidal body of human serum has antigen capacities.

Morphological observations were made on the action of various drugs, of human serum, and of ultra-violet rays, on trypanosomes; the drugs employed were atoxyl, neosalvarsan, "Bayer 205," tartar-emetic, parafuchsin, trypaflavin, pyronin, trypanblue and trypanred. Most of the drugs, and the human serum and ultra-violet rays, acted on the cytoplasm, and tartar emetic alone had a damaging action on the nucleus. Parafuchsin, trypaflavin and pyronin caused the blepharoplast to disappear. "Bayer 205," parafuchsin and trypanred at first stimulate and later paralyse. "Bayer 205" stimulates division of the nucleus and frequently trypanosomes with four to six nuclei are found. The appearance of granules and vacuoles in the cytoplasm, and of rounded forms, signifies a degeneration of trypanosomes. Many rounded forms appear after the administration of tartar emetic. Trypaflavin caused the appearance of intensive granular formation. The origin of these granules is very doubtful. Formation of the vacuole close to the blepharoplast is a specific phenomenon indicating damage to the trypanosome. The blepharoplasts of arsenic-fast and serum-fast strains appear to be more strongly resistant to trypaflavin than the blepharoplasts of the original strains.

W. Y.

SAITO (Masayuki). Das Blutbild der mit Trypanosomen geimpften Tiere. [**The Blood Picture in Trypanosome infected Animals.**]—*Fukuoka-Ikwadaigaku-Zasshi.* (*Fukuoka Acta Med.*) 1927. Nov. Vol. 20. No. 11. German summary pp. 84–85. [In Janpanese.]

The author describes the changes of the blood found in rabbits and mice infected with *T. equiperdum* and *T. gambiense*. There was a decrease of the number of eythrocytes and this was accompanied by a decrease in their haemoglobin content. In rabbits at the beginning of the infection pronounced leucocytosis is to be seen. This is followed by a slight leucopenia with lymphocytosis. Towards the end of the infection there is a

definite leucocytosis with an increase of pseudo-eosinophile cells and a decrease of lymphocytes. The Arneth count shows a displacement towards the left; cells of the first and second class being strikingly increased. The variation in the number of leucocytes is not related to the appearance of trypanosomes in the circulating blood.

In mice there is a sudden increase in the number of white corpuscles, but towards the end of the infection a tendency in the opposite direction. Following an injection of atoxyl there is a leucocytosis of short duration.

W. Y.

CAMPOS (Ernesto de Souza). [In Portuguese & English.] Estudos sobre uma raça neurotropica de *Trypanosoma cruzi.* **Studies upon a Neurotropic Strain of** *Trypanosoma cruzi.—Ann. da Faculdade de Med. de S. Paulo.* 1927. Vol. 2. In Portuguese pp. 197–199. In English pp. 199–201. With 5 figs. on plates. [Microb. Lab., Faculty of Med., S. Paulo, Brazil.]

This investigation was undertaken with the object of throwing light on the nervous type of infection in Chagas's disease. It was suggested by the observation of VILLELA, who noticed pronounced nervous symptoms in a number of infected dogs.

The author inoculated adult dogs from infected puppies and guinea-pigs, and in a second series of experiments dogs were infected by inoculation of trypanosomes obtained from *Triatoma megista.* In addition to dogs, rabbits were also experimentally infected. Nervous phenomena were observed and focal inflammatory lesions containing parasites were seen in sections of the spinal cord. Investigations showed that the tendency to nervous system involvement was in no way modified by prolonged cultivation of the parasites *in vitro.* A brief description is given of the character of the lesions in the spinal cord.

W. Y.

LEDER. Beitrag zur Kenntnis der trypanoziden Substanz im Blutserum bei Hämophilie. [**The Trypanocidal Substance in the Blood Serum of Haemophiliacs.**]—*Muench. Med. Woch.* 1928. Mar. 30. Vol. 75. No. 13. p. 562.

Reference is made to the observation of OPITZ* and ZWEIG that in several cases of haemophilia the serum lacked its protective power when injected into mice infected with trypanosomes. This observation was confirmed by the author, who investigated the trypanocidal power of the serum in a family of haemophiliacs.

W. Y.

KLEINE (F. K.). Mein Anteil an der Schlafkrankheitsexpedition des Völkerbundes. [**My Share in the Sleeping Sickness Expedition of the League of Nations.**]—*Med. Klin.* 1928. Apr. 13. Vol. 24. No. 15 (1218). pp. 566–568. [2 refs.]

This article is simply a summary of the author's work whilst a member of the League of Nations Sleeping Sickness Commission. The matters dealt with are recorded in the Commission's reports and are referred to elsewhere in this *Bulletin.*

W. Y.

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* OPITZ, Ueber die Hämophilie. *Ergeb. f. inn. u. Kindkrkh. Bd. 29.*

CHEVALLIER (Paul) & LÉVY (G.). Un cas de "trypanides," éruption précoce de la maladie du sommeil. [**Early Skin Eruption in Sleeping Sickness.**]—*Bull. Soc. Française Dermat. et Syph.* 1928. Mar. No. 3. pp. 185–187.

The clinical details are given of a case of sleeping sickness contracted in the Congo and special reference is made to the cutaneous eruption.

W. Y.

JOYEUX (Ch.). Les récentes acquisitions sur le traitement de la maladie du sommeil. [**Recent Experience of the Treatment of Sleeping Sickness.**]—*Presse Méd.* 1928. June 9. Vol. 36. No. 46. pp. 731–732.

This is a general revue of the action of drugs recently introduced for the treatment of sleeping sickness. It contains nothing new.

W. Y.

MEDICAL ZOOLOGY.

EWING (H. E.). **Observations on the Habits and the Injury caused by the Bites or Stings of Some Common North American Arthropods.** —*Amer Jl. Trop. Med.* 1928. Jan. Vol. 8. No. 1. pp. 39-62. With 4 text figs. [6 refs.] [U.S. Bureau of Entomology, Washington, D.C.]

With the notorious exception of *Lathrodectes mactans*, the "black widow" spider, the species of arthropoda considered in this paper are not very seriously hurtful. The Buthid scorpion *Centruroides vittatus* inflicts a wound little worse than a bee's sting. The "whip scorpion" *Mastigoproctus giganteus* is as innocuous as all the other species of his tribe elsewhere. The bite of the big Mygaliid spiders *Eurypelma californica* and Pamphobeteus, causes nothing more than a transient smart, and that of the kindred trap-door spider *Pachylomerus audouinii* causes some slight numbness in addition. Of three species of wolf spiders mentioned the worst (*Lycosa sp.*) causes little more hurt than a bee. The "black widow," however, is in a different category (see this *Bulletin*, Vol. 23, p. 875, and Vol. 24, pp. 401, 895, 896). The long-legged centipede *Scutigera forceps* is not to be feared for its bite, but may be appreciated as a destroyer of bed-bugs. *Benacus griseus*, one of the giant water-bugs, emits its saliva with a will, and its bite causes a burning pain and some local swelling and hyperaemia. The bite of the Reduviid bug *Nabis rosipennis* is said to be like that of a mosquito and to cause irritation that may be felt and seen two days afterwards.

A. Alcock.

MACKERRAS (I. M.). **The Mosquitoes of the Sydney District.**—*Rep. of Director-General of Pub. Health New South Wales for Year 1926.* pp. 165–168.

The list of 27 mosquitoes of the Sydney District includes *Culex fatigans* and *Anopheles annulipes, atratipes,* and *stigmaticus*, but explicitly repudiates *Aëdes argenteus*. Mosquito-borne disease is a negligible quantity, but the prevalent domestic *Culex fatigans* and salt-marsh *Aëdes vigilax* are pests. The use of mosquito-nets gives good protection against them, and it is doubtfully justifiable to attempt to control breeding-places while the housefly, which is vastly more important, is allowed to thrive.

A. A.

NEWSTEAD (R.) & CARTER (H. F.). **Mosquitos on Ships arriving in the Port of Liverpool from West Africa.**—*Ann. Trop. Med. & Parasit.* 1927. Dec. 31. Vol. 21. No. 4. pp. 419–423.

Between May, 1920, and March, 1921, twenty-two ships arriving in Liverpool from West African ports were seached to exhaustion, and as soon as possible—often a few hours—after arrival, for living mosquitoes. In only one ship of them all were any found—3 female *Culex fatigans*. Two of these were brought ashore, and were kept in a very congenial environment where one of them lived for 31 days, and the other for 60 days, without biting and without laying eggs. The ship in question

had been invaded by mosquitoes when lying about half-a-mile off Port Gentil, and mosquitoes had been active on board up to a two days' run from Liverpool.

A. A.

HAMLYN-HARRIS (Ronald). **The Relation of Certain Algae to Breeding Places of Mosquitoes in Queensland.**—*Bull. Entom. Res.* 1928. May. Vol. 18. Pt. 4. pp. 377–389. [14 refs.]

This is an interesting and judicious paper and should be read and digested. The author's observations and experiments during a term of 18 months with two species of Nitella lead him to conclude that Characeae do not possess any inherent larvicidal properties. On the other hand he finds that *Cladophora holsatica*, one of those algae that forms cushions and floating balls and also gives off a repulsive odour, does inhibit the growth and development of larvae. The examination of a large number of waterholes in which no larvae—sometimes no living things of any sort—were to be found countenances the opinion that ferrous oxide and salts of alumina are interdictive. The attractiveness of *Spirogyra nitida* and other green Confervoids as food for Anopheles larvae is noticed.

A. A.

SENIOR-WHITE (Ronald). **Algae and the Food of Anopheline Larvae.**—*Indian Jl Med. Res.* 1928. Apr. Vol. 15. No. 4. pp. 969–988. With 1 coloured plate. [14 refs.] [Central Malaria Bureau, Kasauli.]

The author finds, by comparing the plankton of the medium with the contents of the gut of anopheline larvae living in it, that the larvae feed upon whatsoever organism occurs in greatest abundance, although there is evidence of a preference for diatoms and, perhaps, spores of fungi. By comparing the increase or decrease of organisms in pure cultures in which anopheline larvae were browsing and in similar cultures that were vacant, he estimates that anopheline larvae have a filtration-capacity of about 200 to 1,000 cmm. of water per diem according to age. He finds also that in temporary rain-pools the greatest concentration of plankton is some millimetres below the surface—more convenient for culicine than anopheline larvae. He also finds that copper-sulphate, even in concentrations much greater than are permissible in the field, is not effective against certain species of algae.

A. A.

BARBER (M. A.) & KING (C. H.). **The Tadpole of the Spadefoot Toad an Enemy of Mosquito Larvae.**—*Public Health Rep.* 1927. Dec. 30. Vol. 42. No. 52. pp. 3189–3193. With 2 text figs. [2 refs.]

The Batrachian tadpole living in natural conditions is usually herbivorous, but the authors have observed tadpoles of the spadefoot toad, *Scaphiopus hammondii*, a N. American and Mexican species, to feed freely on mosquito larvae— and not merely when placed with

the larvae in a pan [where, possibly, the hungry tadpoles had nothing else to eat and might have fed upon their own kind], but also when let loose in a borrow-pit containing mosquito larvae and crustaceans [where, presumably, the tadpoles had a choice of vegetable food]. Barber also mentions evidence of his own, of tadpoles in the Philippine Islands eating mosquito larvae. In discussing the utility of colonizing Scaphiopus the authors do not fail to observe that its habitat is in temporary pools, and that its season is early in the summer and short [these particulars presumably refer to the (significant) tadpole stage].

A. A.

NEWHAM (H. B.). **A Simple Preventive of Mosquito Bites.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1928. Feb. 25. Vol. 21. No. 5. p. 427. [London School of Hyg. & Trop. Med., London.]

A lady in the Madras Presidency states that she repels mosquitoes with infinite comfort by applications of the juice of the common Indian lime (*Citrus acida*). She slices a fresh lime and rubs the cut surface well over parts liable to be bitten, letting the juice dry on the skin.

A. A.

LEGENDRE (J.). La lutte contre les moustiques par la concurrence larvaire entre zoophiles et androphiles. [**Larval Association of Zoophiles and Androphiles in the Fight against Mosquitoes.**]—*C.R. Acad. Sci.* 1927. Dec. 19. Vol. 185. No. 25. pp. 1520–1522.

The author repeats the story of his having carried eggs and larvae of a strictly "zoophile and androphobe" race of *Culex pipiens* from Portrieux in Brittany to Pons, where the local race of *Culex pipiens* was violently and vexatiously "androphile," in the hope that the "androphobe" immigrants would evict the noxious "androphile" natives—a hope that was fulfilled the very next year. He now, three years afterwards, can find only "androphobe" mosquitoes at Pons in such places as he has examined. The supposition appears to be that the struggle between the misanthropes and the philanthropes occurs in the larva stage.

A. A.

MATHESON (Robert) & HINMAN (E. H.). *Chara fragilis* **and Mosquito Development.**—*Amer. Jl. Hyg.* 1928. Mar. Vol. 8. No. 2. pp. 279–292. With 1 chart. [22 refs.] [New York State College of Agric., Cornell Univ., Ithaca, N.Y.]

While studying the mosquitoes of central New York, Matheson came upon "a deep spring-fed pool," having a rich growth of *Chara fragilis*, and quite devoid of mosquito larvae, although separated only by an embankment from a marshy lake where larvae of Anopheles and Culex were to be found in considerable numbers. The said pool was kept under observation for two summers, "but no mosquito

breeding occurred in it," although it contained an abundant plankton. (It should be noted that the pool was on higher ground than the lake, into which it had a constant outflow.)

Some of this Chara was transferred (*a*) to a wooden pail filled with unfiltered water "to which were added leaves," and (*b*) to a wooden pail "filled with water," and these two pails were sunk in the ground near 4 similar pails "filled with unfiltered water well supplied with decaying leaves," but not containing Chara—for control. In all these pails *Culex territans* appears to have dropped its eggs, and the eggs hatched; but whereas in the 4 control pails the larvae consummated their development, in the Chara pails "none succeeded in pupating." Subsequently, during the summer, eggs (of this Culex) were dropped constantly in the control pails, but not in pail *a*, where the Chara continued to flourish. Larvae of *Anopheles punctipennis* did, however, appear in pail *b*, where the Chara did not flourish well, and these larvae attained their adult wings.

While these experiments were in progress some Chara "was added to a pail containing rainwater and developing larvae of *Culex territans*," and "the larvae continued their development and numbers transformed, but how many was not determined." Subsequently—75 days after—eggs of this species appeared in this pail and hatched, but died in 2 or 3 days; still later larvae of *Anopheles punctipennis* were found in it "but none were observed to transform to pupae."

From the above experiments the authors concluded that *Chara fragilis* appears to be both larvicidal and repellent to mosquitoes. In further experiments—which are tabulated and not individually described—the authors put large numbers of larvae of several (4) species of mosquitoes into vessels containing Chara, with water from a stream known to them to be suitable for mosquito breeding, and they found in the course of 44 experiments that in every instance there was a great mortality of larvae, and that in 22 experiments not a single adult emerged. Furthermore, they placed five cages, made of mosquito-netting 14 meshes to the inch, in the pool where the *Chara fragilis* was found to begin with; four of the cages contained 300 larvae in various stages of development, and one contained 500 very young larvae. These cages were examined three, ten, and 17 days afterwards: at the first examination larvae were present in all the cages except the one containing the very young ones, and one adult was also observed; at the second examination three adults were seen, but it was difficult to find larvae in any of the cages; at the fourth examination neither "living larvae nor adults could be found in any of them."

Experiments with dried *Chara fragilis* followed, large numbers of larvae being placed in vessels containing "ordinary stream water" (2 litres) and finely-powdered Chara then added. Small larvae by the hundred were killed off altogether, in less than four days, by the addition of 4 gm. of Chara powder, and there was also a mortality ranging from 19·5 to 82 per cent. among large larvae with doses varying from 1 to 4 gm. "Water taken from Chara aquaria of known lethal activity has no apparent retarding or lethal action on larval development."

"The lethal action of this plant [*Chara fragilis*] would seem to be closely associated with high pH. The pH seems to vary directly with the degree of photosynthetic activity."

A. A.

BARBER (M. A.). **The Food of Culicine Larvae. Food Organisms in Pure Culture.**—*Public Health Rep.* 1928. Jan. 6. Vol. 43. No. 1. pp. 11–17. [2 refs.]

Having very successfully reared Anopheles larvae, hatched from sterilized eggs, on pure cultures of bacteria alone, infusoria alone, and algae alone, the author has since carried on the same process equally successfully with larvae of *Culex quinquefasciatus* and *Aëdes aegypti* on these pure cultures and also on pure yeast. In rearing other species he has also used cultures of mixed bacteria and combinations of the above cultures with satisfaction. The material must be living; "no considerable growth of larvae was obtained in sterile nutrient media or in cultures provided only with dead organic material." Success did not appear to depend upon a strict observance of H ion concentration.

A. A.

DUNN (Lawrence H.). **Further Observations on Mosquito Breeding in Tree-Holes and Crab-Holes.**—*Bull. Entom. Res.* 1928. Feb. Vol. 18. Pt. 3. pp. 247–250.

Observations on two tree-holes were carried on in a compound at Yaba in Nigeria. The holes were examined at five-day intervals for a term of 325 days. One hole, about two inches in diameter and 6½ inches deep and leading into a cavity shaped like a bottle with a capacity of about 355 cc., was in the fork of a shady dika-nut tree and about 3½ feet from the ground; water was found in it at 32 of the 66 examinations and mosquito larvae at 30; from all these larvae 430 adults were reared—4 being *Aëdes aegypti*. The other hole formed a basin 8 inches in diameter and 3½ inches deep and about 900 cc. capacity, in the top of a sprouting stump (about 3 feet high) of a mango-tree, and was not always shaded; water was collected in it at 34 of the examinations, and mosquito larvae at 32; from the larvae 875 adults were reared, 218 being *Aëdes aegypti*.

Observations of 200 crabholes along the margin of a lagoon at Lagos in Nigeria were made during a term of about 3 months, the water being sucked out from the depths of the hole. Mosquito larvae were found in 113 holes, from which 4,356 adults were reared, including 26 *Anopheles gambiae*, 10 *Aëdes aegypti*, and 17 *Culex fatigans*.

A. A.

RUDOLFS (W.). [**Investigations of Mosquito Problems carried on at the New Jersey Agricultural Experiment Stations during the Past Year.**]—*Proc. 13th Ann. Mtg. New Jersey Mosquito Exterm. Assoc., Atlantic City, 1926.* New Brunswick, N.J. pp. 33–54. [6 refs.] [Summarized in *Rev. Applied Entom.* 1927. Nov. Vol. 15. Ser. B. Pt. 11. pp. 199–200.]

The cause of the disappearance of oil applied to a river polluted with sewage was attributed mainly to hydrocarbon-digesting bacteria—shown by appearance of sugar and soluble starches. Of mosquito repellents thuja oil, cinnamic-aldehyde, anisic-aldehyde, bergamot oil, clove oil, and pyrethrum-extract were found the most effective; when mixed with an ointment the protective effect lasts 2–3 hours. The observations here recorded confirm the commonsense conclusion that a suitable food-supply for the larvae is the chief factor in mosquito-breeding waters and that this is determined by the chemical composition of the water.

A. A.

EDWARDS (F. W.) & GIVEN (D. H. C.). **The Early Stages of some Singapore Mosquitoes.**—*Bull. Entom. Res.* 1928. May. Vol. 18. Pt. 4. pp. 337–357. With 9 text figs. [British Museum, Nat. Hist., London, S.W. 7.]

Interesting entomological detail; among other items are the results of an investigation of the mosquito-life of pitcher-plants (Nepenthaceae). Many thousands of larvae, representing 16 species of mosquitoes (6 Culex, 3 Armigeres, 3 Rachionotomyia, 2 Uranotaenia, a Megarhinus, and on one occasion an Anopheles) were found in the large number of Nepenthes pitchers examined.

A. A.

NITZULESCU (Virgil). Contribution à l'étude de la pompe salivaire des culicides. [**The Salivary Pump of Culicidae.**]—*Bull. Soc. Path. Exot.* 1927. Nov. 9. Vol. 20. No. 9. pp. 851–857. With 6 text figs. [4 refs.] [Parasit. Lab., Faculty of Med., Paris.]

The salivary pump of Culicids is here considered in very particular detail and compared with that of Tabanids and Simuliids—and also with the descriptions of previous authors.

A. A.

KLIGLER (I. J.). **Simple Method of feeding Stegomyia on Blood or Mixtures containing Cultures.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1928. Jan. 31. Vol. 21. No. 4. pp. 329–331. With 1 text fig. [Dept. of Hyg., Hebrew Univ., Jerusalem.]

A successful method of infecting Stegomyias with *Leptospira icteroides* by getting them to feed on suspensions (in defibrinated or citrated blood) of cultures of that organism is here described. The insects to be infected are confined (2 to 4 at once) in a wide-mouthed sterile test-tube, the mouth of which is made taut (in the usual way) by a stretch of fine-meshed sterile cotton-gauze instead of by a plug of cottonwool.

The feeding is carried out as follows :—

"A small quantity of a young active culture is added to defibrinated or citrated blood, the two thoroughly mixed, and small amounts of the mixture placed in small sterile petri dishes. The tube containing the mosquitoes is held at first with the gauze to the light so that the insects come to rest on the gauze. Without disturbing them the tube is lowered carefully into the blood mixture so that the gauze comes in contact with the blood. If conditions are favourable, some or all of the mosquitoes usually begin to feed almost at once, and in a few minutes become partly or completely engorged. The fully engorged mosquitoes may then be transferred to a cage and the rest dissected in order to see the condition of the blood and the leptospira in the gut. As a rule the non-engorged mosquitoes, and even those which apparently had not fed, contained varying quantities of blood, and many active leptospira could be demonstrated in the gut contents examined with the dark field. The partially engorged mosquitoes will readily complete their feed on man or animal, should that be desired. At various intervals after feeding, they may be dissected or fed on animals, as the case may be. It may be of interest to note here that an engorged mosquito has taken up, approximately, one to two mgm. of blood. To avoid introducing foreign solid matter into the mosquito, liquid cultures, or the supernatant suspension of centrifugalized semi-solid cultures, should be used. Either defibrinated or citrated blood may be employed, but, when citrated blood is the food, it is

desirable to keep the concentration of citrate down to 0·2 per cent. (the minimum necessary to prevent clotting in the test-tube), since higher concentrations of citrate are injurious to leptospira.

It is best to hold the tube in an inclined position so that only part of the gauze is moistened by the blood."

A. A.

ROUBAUD (E.). L'éclosion de l'oeuf et les stimulants d'éclosion chez le *Stegomyia* de la fièvre jaune.—Application à la lutte antilarvaire. [**Hatching of Egg and Stimulants thereto in the Yellow Fever Stegomyia.**]—*C.R. Acad. Sci.* 1927. June 13. Vol. 184. No. 24. pp. 1491–1492. [3 refs.]

It is well known that eggs of many species of Aedes, including *Ae. argenteus* (*Stegomyia fasciata*), may remain alive and unhatched for many months. According to the author, the eggs of *Ae. argenteus* are of two kinds, both of which may occur in the same batch. Those of the one kind hatch in 3 or 4 days, without any special stimulus, and even if placed in sterile water. The other and commoner kind of eggs do not hatch for months, and then only under the influence of some special stimulus, biochemical or chemical—usually a microbiotic ferment. Experimentally, a weak solution of sodium hypochlorite is almost as efficacious as a ferment. The author, therefore, is of opinion that since these resistant eggs will survive antilarval treatment in a yellow fever area, "detective" operations with a 0·1 per cent. solution of sodium hypochlorite are an essential preliminary of yellow fever prophylaxis.

A. A.

GALLIARD (Henri). Contribution à l'étude des culicidés d'Espagne. [**Culicidae of Spain.**]—*Ann. Parasit. Humaine et Comparée.* 1928. Apr. 1. Vol. 6. No. 2. pp. 206–210. With 2 text figs. [Anti-Malarial Inst., Navalmoral de la Mata, Spain, & Parasit. Lab., Faculty of Med., Paris.]

The author mentions the larvae of several species of Culex found in waters in central Spain that are also inhabited by *Anopheles maculipennis* and *hispaniola*, which are the only anophelines found there by him. Further south, in the Morena mountains, *Culex mimeticus* seems to be intimately associated with *A. hispaniola*.

A. A.

MARTINI (E.), IRFAN (J.), MAHMUD (S.) & VOGEL (R.). Beiträge zur Stechmücken- und Malariakunde Anatoliens. [**Contributions to the Knowledge of the Mosquitoes and Malaria of Anatolia.**] I. Stechmückenfangplätze in Anatolien. 1926 [IRFAN & VOGEL].—*Abhandl. a.d. Gebiet d. Auslandskunde. Hamburg. Univ.* 1927. Vol. 26. (D., Med. & Vet. Vol. 2.) [Festschrift NOCHT.] pp. 286–292; II. Beiträge zum Studium der Morphologie und Biologie der Anopheleslarven in der Umgebung von Aïdin [MAHMUD].—*Ibid.* pp. 292–298; III. Ueber die Ökologie der Anopheleslarven in der Umgebung von Aidin [MAHMUD].—*Ibid.* der Anophelen in Anatolien [VOGEL & MARTINI].—*Ibid.* pp. 298–308; IV. Einiges ueber die Malariaverhältnisse in Anatolien [MARTINI] —*Ibid.* pp. 308–313.

These careful studies, reported in great detail, are for the most part of local interest for Anatolia. Thirty-eight species of Culicidae

are here, for the present, recorded from that province, of which 8 are Anophelines, namely, *A. bifurcatus, algeriensis, nigripes, sinensis, multicolor, maculipennis, elutus*, and *superpictus*. Of these only the last three are of real importance in connexion with malaria, they being abundant, of wide occurrence, and of house-haunting habit. *A. bifurcatus*, a not unimportant species elsewhere, may here be only a localized danger in certain thinly-peopled mountainous parts. The natural breeding-places in the neighbourhood of Aidin are described in great detail; those of *maculipennis* and *elutus*—the larvae of which species are commonly found together all the year round—are in open, standing water of no great depth; those of *superpictus* are in pools in the beds of brooks and streams, and as such pools are plentiful only in summer when the streams are running low, the larvae of this species are found only at that season. The malaria of Anatolia is simple tertian and subtertian; quartan was not observed. It is not uncommon to find villages where nearly all the children examined are infected. Malarial cachexia is common. Quinine-resistant cases are to be met with, and the Turkish doctors think that concurrent helminth-infestation may dispose to such resistance. Blackwater occurs, but is not very common. The effects of local seasonal occupations and habits upon the local incidence of malaria is discussed at length.

A. A.

BALFOUR (Marshall C.). **Studies on the Bionomics of North American Anophelines. Winter Activities of Anophelines in Coastal North Carolina (36° N. Lat.).**—*Amer. Jl. Hyg.* 1928. Jan. Vol. 8. No. 1. pp. 68–76. With 2 charts. [4 refs.]

These observations relate to certain coast tracts of N. Carolina lying about 36° N. There *Anopheles quadrimaculatus* and *punctipennis* pass the winter both as larvae and as adults and *A. crucians* as larva and probably as adult also. The larvae in 1926–27 stood a spell of several days of three-inch ice on all breeding-places, and a ten-day spell having a mean minimum of −4° C. and an absolute minimum of −11° C.

A. A.

BOYD (Mark F.) & FOOT (Helen). **Studies on the Bionomics of American Anophelines. The Alimentation of Anopheline Larvae and its Relation to their Distribution in Nature.**—*Jl. Preventive Med.* 1928. May. Vol. 2. No. 3. pp. 219–242. With 10 text figs. [3 refs.] [Station for Field Studies in Malaria, Edenton, North Carolina.]

These studies on the nature of the food of the larvae of *Anopheles quadrimaculatus* and *punctipennis* in North Carolina were continued for three terms of four months each. The fourth stage larvae of these species appear to ingest the same elements of the plankton, the commonest of a multitude of elements being the protozoa, Trachelomonas and Arcella; the green algae, Eugloena, Closterium, and Cosmarium; and the diatom Navicula. Despite this similarity in tastes *quadrimaculatus* larvae are found "chiefly in situations where the variety of food is relatively greatest" (ponds and waters with imperceptible current), and *punctipennis* larvae "in situations where the range of their diet is relatively lower" (moving waters). The

authors think that the richer plankton of ponds may be attributable to their water being warmer than that of streams, and therefore conclude that the distribution of *A. quadrimaculatus* and *punctipennis* is not controlled by nutritional factors, but that perhaps causes of a thermal nature may exercise an important influence.

A. A.

HOFFMANN (Carlos C.). Zur Kenntnis der Anophelen Mexikos. [**A Notice of the Anopheles of Mexico.**]—*Abhandl. a.d. Gebiet d. Auslandskunde. Hamburg. Univ.* 1927. Vol. 26. (D., Med. & Vet. Vol. 2.) [Festschrift NOCHT.] pp. 184–196. With 5 figs. on 2 plates. [Dept. of Public Health, Mexico.]

Of the eight species of Anopheles occurring in Mexico—*A. crucians, A. quadrimaculatus, A. punctipennis, A. albimanus, A. pseudopunctipennis, A. vestitipennis, A. argyrotarsis, A. strigimacula, A. apicimacula, A. neivai,* and *A. eiseni*—the first three belong to the northern part of the country and the other five mainly to the southern part. The local distribution of these species is here considered in great detail. *A. albimanus* and *A. pseudopunctipennis* are declared to be, in respect of malaria, the most dangerous species for Mexico ; the former is the commonest species along the entire extent of both coasts of the country in the rainy season, the latter frequents less humid tracts. *A. vestitipennis* and *A. argyrotarsis* are dangerous in certain localities, especially in the south-east of Mexico, but the other four southern species are regarded by the author as not important.

A. A.

ROUBAUD (E.). Nouvelles recherches sur l'évolution zoophile des faunes d'anophèles en Europe (*A. maculipennis*) d'après les données de l'armement maxillaire. [**The Maxillary Armament of Anopheles in Europe.**]—*Ann. Inst. Pasteur.* 1928. May. Vol. 42. No. 5. pp. 553–618. With 16 text figs. [20 refs.]

Roubaud's theory of a " zoophile " or " zootropic " race of *Anopheles maculipennis* was reviewed in this *Bulletin* for 1922 (Vol. 19, pp. 476–478) and is here again expounded, and expanded. A " zootropic " race is one the females of which, having become adapted for feeding exclusively on stalled beasts, will not touch man, and therefore are innocent of malarial infection. These " zootropic " females are distinguished by their maxillae, the denticles of which, having to pierce an animal hide, are more numerous than those of the Anopheles that habitually feed on thinner-skinned man—their number under the constant conditions of " zoophile " existence being 15. In " non-zoophile " races of *Anopheles maculipennis*—races that in the absence of cattle feed precariously, and commonly prey on man—the number of maxillar denticles is less than 14 ; or, in places where there appears to be a choice between cattle and man, yet owing to the paucity of cattle the exercise of that choice is restricted, the number of maxillar denticles may under the stress of competition for cattle-blood vary up to 16 or 17.

The argument set forth in the present paper is that the " zoophile " or " zootropic " modification of *Anopheles maculipennis* (with its exact maxillar denticular formula 15) has come about almost mechanically from the constant conjunction of two favouring circumstances

unwittingly provided by man in his efforts to improve the sanitation of agricultural tracts liable to flooding. In such tracts man, by collecting and bounding the surface waters, has established equable breeding-grounds for a settled population of these mosquitoes, and by installing permanent herds of cattle in propinquity to these breeding-grounds has provided the female insects with a constant, abundant and convenient supply of their favourite food. Everything is explained by this uniform constancy of an ideal environment; for, in the author's phrase, "zoophily" has been evoked and perfected *pari passu* with improvement in the conditions of existence for man, domestic animals, and mosquitoes all alike—a happy solution of the riddle of the painful earth.

A. A.

WILLIAMSON (K. B.). **Mosquito Breeding and Malaria in Relation to the Nitrogen Cycle.**—*Bull. Entom. Res.* 1928. May. Vol. 18. Pt. 4. pp. 433–439. [17 refs.]

An interesting argument supporting the general conclusion that deficient oxidation of waters containing excess of nitrogenous matter is fatal to higher forms of aquatic animal life, and approving the suggestion made many years go by Sir Malcolm WATSON that dangerous Anopheles might be overcome by convenient pollution of their breeding-waters.

A. A.

GUELMINO (D.). Beitrag zum Studium der Biologie der Anophelen in Mazedonien. [**Biology of Anopheles in Macedonia.**]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1928. Feb. Vol. 32. No. 2. pp. 87–91. [Hyg. Inst., Skoplje.]

A study of the biology of *Anopheles maculipennis, superpictus*, and *bifurcatus* in Macedonia.

In some parts of Macedonia *A. maculipennis* contributed 46 per cent. of the hibernating Anopheles collected. During hibernation the female is passive until about the middle of January; thereafter the ovaries begin to grow, and eggs are laid about the middle of March, the inundated state of the country being then most auspicious. Males of the first generation of the year are seen about the end of April. Numbers attain their maximum at the end of May and first half of June and then as the country dries up they decrease. Of 2,000 hibernating females dissected not a single one yielded sporocyst or sporozoite.

A. superpictus hibernates in stables in company with *maculipennis*, forming 54 per cent. of the collection in the winter of 1926–27. The ovaries do not begin to ripen until the middle of February. Eggs are laid about the middle of April, in streams. The adults of the first generation show up in May, but after the middle of that month their numbers are suddenly checked, this being due to the fact that the streams in which the larvae live are swollen by the spring rains and overflow their banks, sweeping away many larvae to destruction. In June, with the onset of hot dry weather, regular conditions are again established for the secure multiplication of this species. Of 2,000 hibernating females examined none gave evidence of malarial infection.

A. bifurcatus, which is widely spread in Macedonia, hibernates there as elsewhere in the larval stage. Eggs are deposited in October, and the larvae reach their third or fourth stage early in winter ; then they remain quiet at the bottom of the water until the latter half of February. The first generation of adults appears at the end of March or beginning of April.

A. A.

BARRAUD (P. J.) & COVELL (G.). **The Morphology of the Buccal Cavity in Anopheline and Culicine Mosquitoes.**—*Indian Jl. Med. Res.* 1928. Jan. Vol. 15. No. 3. pp. 671–680. With 50 figs. on 8 plates. [1 ref.] [Central Malaria Organization, Kasauli, India.]

This investigation of the buccal cavity of the female in 86 species and 3 varieties of Anophelines and 48 species of Culicini was made with the object of determining the condition of the buccopharyngeal armature described in an earlier paper by SINTON and Covell.

In respect of the Anophelines it is found that in 30 of the species, including representatives of the Anopheles (*s.s.*), Myzorhynchus, Bironella, Christya, and Aribalzagia sections, the buccopharyngeal armature is absent ; that in 14 of the species, including representatives of the Myzomyia, Neomyzomyia, and Nyssorhynchus sections, it consists of a single row of 8 to 10 (in two cases 12 to 14) large separate teeth ; that in 4 of the species, namely, *A. argyrotarsis*, *brasiliensis*, *albimanus* and *tarsimaculatus*, it consists of two rows of teeth very much and characteristically recurved ; that in 28 species, including representatives of the Myzomyia, Nyssorhynchus, Neocellia, and Cellia sections, it consists of a double row of teeth with 12 to 14 in each row ; and that in 13 species, including representatives of the Myzomyia, Pseudomyzomyia, Neomyzomyia, and Cellia sections, it consists of a double row of 18 to 26 (in two cases 14 to 16) in each row. Thus it is found that species having strong general resemblances [and justly for that reason being regarded as closely akin] may differ in this one point of the buccopharyngeal armature ; [and this, of course, is only to be expected, since classification by a single arbitrarily-chosen character gives a notoriously deceptive indication of natural affinity and in the history of taxonomic zoology has again and again from of old led back to chaos].

A. A.

ADOWA (A. N.) & RAVITSCH-TSCHERBO (M. I.). Sur la teneur en oxigène des eaux tourbeuses. [**Oxygen Tension of Bog Waters.**]—*Russian Jl. Trop. Med.* 1927. Vol. 5. No. 10. French summary p. 675. [In Russian pp. 639–642. With 2 text figs. Refs. in footnotes.]

SMORODINZEW (J. A.) & ADOWA (A. N.). Sur la réfraction des eaux tourbeuses en rapport avec l'application de la réfractometrie en biologie.—*Ibid.* French summary p. 675. [In Russian pp. 635–638. Refs. in footnotes.]

The tenor of both these papers is confirmatory of observations previously published, that (Sphagnum) bog marshes, as compared with sedgy (Carex) marshes, are inhospitable to Anopheles larvae. Among the unfavourable factors of Sphagnum waters, as indicated

in the first paper, are a low oxygen tension concurrent with a high percentage of organic matter; and, as indicated in the second paper, a high refractive index along with a low mineral content.

A. A.

SEBENZOW (B. M.) & ADOWA (A. N.). Conditions biologiques et physico chimiques qui règlent le cantonnement des larves d'*Anopheles maculipennis* dans les tourbières. [*Anopheles maculipennis* **and its Relation to Peat Bogs.**]—*Russian Jl. Trop. Med.* 1928. Vol. 6. No. 2. French summary pp. 142–143. [In Russian pp. 89–105. Refs. in footnotes.]

Peaty waters in the environs of Moscow are here stated to be of two types—Sphagnum (bog moss) waters and Carex waters. The former are too poor in aliment to support larvae of *Anopheles maculipennis*, the latter resemble lacustrine waters and are richer in life. Naturally, waters of intermediate character exist.

A. A.

RODENWALDT (Ernst). Kaart en determineertabel van de larven der anophelinen van Ned. Oost-Indië. [**Chart and Identification Key of Anopheline Larvae of Dutch East Indies.**]—1 folding table & 16 figs. on 2 folding plates. Uitgegeven door den Dienst der Volksgezondheid.

These charts include individual diagnoses and a key for the identification of the larvae of 16 species and varieties of Anopheles occurring in the Netherlands East Indies. Each diagnosis is illustrated by a very clear figure, enlarged about 25 diameters, of the anterior half (head, thorax, and first two abdominal somites) of the respective larva. In this series of figures the diagnostic features of each species are emphatically demonstrated, so that although all the text is in Dutch the identification of species is easy.

A. A.

INGRAM (Alexander) & DE MEILLON (Botha). **A Mosquito Survey of Certain Parts of South Africa, with Special Reference to the Carriers of Malaria and their Control. Part I.**—*Publications of the S. African Inst. for Med. Res.* 1927. Oct. Vol. 4. No. 22. 81 pp. With 53 figs.

The contents of this volume include mosquito surveys of certain parts of Northern Transvaal, and of the coastal belt of Zululand, and descriptions of new species of mosquitoes discovered in Zululand. The reports of the surveys include a notice of the physical features and meteorology of the districts surveyed and some account of places visited, and lists of the species of mosquitoes collected and bred. For the species of Anopheles details are given of the local incidence and breeding-grounds at the various places visited. In the northern parts of the Transvaal 13 species of Anopheles exist, namely, *mauritianus*, *squamosus*, *gambiae* (=*costalis*), *pretoriensis*, *rufipes*, *funestus*, *natalensis*, *transvaalensis*, *maculipalpis*, *longipalpis*, *rhodesiensis*, *theileri*, and *cinereus*. Thirteen species of Anopheles are also found in the coastal belt of Zululand, ten of them being identical with the first ten of the

Northern Transvaal list, the other three being *ardensis*, *nili*, and *pharoensis*. The species chiefly responsible for malaria both in the Transvaal and Zululand are *gambiae* (=*costalis*) and *funestus*.

A. A.

SWELLENGREBEL (N. H.) & DE ROOK (H.). Densité de la population et anophélisme. (**Density of Population and Anophelism.**)—*Riv. di Malariologia.* 1928. Jan.–Feb. Vol. 7. No. 1. pp. 4–6. [1 ref.] [English summary pp. 80–81.] [Inst. of Trop. Hyg., Amsterdam.]

The authors determined (by fumigation) the numbers of Anopheles sheltered severally in piggeries situated at three stations in and near a rural area under continuous antilarva control with "liquid (paraffin) vaseline." Station No. 1 was in the middle of the controlled region, near a town; station No. 2 was near three isolated farms at the edge of the controlled region; station No. 3 was quite outside the controlled region and near a village; all three stations were carefully chosen as naturally equally attractive from the Anopheles point of view, except that No. 1 and No. 2 were near inhabited centres, and No. 3 included only three isolated farms.

The total counts of Anopheles during 4 months (June–September) were as follows:—

	Per sq. metre.	Per pig.
Station No. 1	16	92
,, No. 2	85	289
,, No. 3	48	264

The results, according to the authors' statement, confirm the conclusion of Ross that in an area where the numbers of Anopheles remain constant the number of Anopheles per head increases when the population decreases. At Station No. 2 the population was the least and the number of Anopheles the most.

A. A.

SHANNON (R. C.), DAVIS (N. C.) & DEL PONTE (E.). La distribución del *Anopheles pseudopunctipennis* y su relación con el paludismo en la Argentina. [**The Distribution of** *A. pseudopunctipennis* **and its Relations to the Prevalence of Malaria in the Argentine.**]—*Rev. Inst. Bacteriolog.* Buenos Aires. 1927. Mar. Vol. 4. No. 7. pp. 679–705. With 12 text figs. & 3 maps. [29 refs.]

The most important malarial zone comprises Jujuy, Salta and Tucumán, and small districts of Catamarca, La Rioja, San Luis, and north-west Córdoba—regions, with the exception of San Luis, where *A. pseudopunctipennis* thrives. Of less marked prevalence were the rivers Bermejo, Paraná and Paraguay and the adjacent provinces of Corrientes and Santa Fe. Here *Nyssorhynchus* (*albitarsis*, *argyritarsis* and *albimaculatus*) appeared to be the vectors.

A. pseudopunctipennis breeds in permanent pools where there is much aquatic vegetation, in swamps formed by running water containing Spirogyra, in rice-fields, and generally in hilly districts where the water contains abundant algae.

The freedom of Buenos Aires from malaria is ascribed to the absence of *A. pseudopunctipennis*, the other species not being vectors there.

H. Harold Scott.

SHANNON (Raymond C.) & DAVIS (Nelson C.). Condiciones de reproducción de *Anopheles pseudopunctipennis* en la provincia de Tucumán durante la estación seca. [**Conditions of Reproduction of *A. pseudopunctipennis* in Tucuman in the Dry Season.**]—*Rev. Inst. Bacteriológ.* Buenos Aires. 1927. Mar. Vol. 4. No. 7. pp. 662–677. With 5 text figs. [2 refs.] English summary pp. 677–678.

Anopheles pseudopunctipennis, the chief carrier of malaria in Argentina, continues to breed throughout the year; during the dry season its numbers are diminished, the breeding-places being restricted to broken ground of perennial springs and mountain streams; during the cold season the growth of the larva is retarded.

A. A.

EVANS (A. M.). **The Discovery of a Specimen of *Anopheles funestus* collected in Mauritius in the Year 1907 or 1908.**—*Ann. Trop. Med. & Parasit.* 1927. Dec. 31. Vol. 21. No. 4. pp. 425–426. [4 refs.]

At the Liverpool School of Tropical Medicine a specimen of *Anopheles funestus* has lately been found in a collection of Mauritius mosquitoes that is labelled with the name of Ross and the date 1908. [This species was observed by MACGREGOR to be abundant in Mauritius in 1922–23: its existence there is another link in the theory of a "Lemuria" connexion betweeen Africa and India.]

A. A.

IATZENKO (Th. I.). Sur la zoophilie de l'*Anopheles maculipennis* en Ukraine. [**The Zoophily in Ukraine of *A. maculipennis*.**]—*Bull. Soc. Path. Exot.* 1928. Apr. 18. Vol. 21. No. 4. pp. 322–323. [Ukraine Inst. for Study of Protozoal Diseases.]

In many places in Ukraine *Anopheles maculipennis* shows a preference for cattle, undoubtedly to the benefit of human beings, but without any observed modification of its maxillary denticles; nor has any correspondence between the number of these denticles and the size of the mosquito been observed. The utility of cattle as a defence against anopheles is discounted in the following circumstances.—The contiguity of anopheles and man in rural occupations, and the existence of residences and stables under a common roof; damp and dark houses, ponds near houses, and bright lights at night; absence or scarcity of cattle near breeding-grounds of anopheles; cold and draughty stables and cattle-sheds; insufficient numbers of cattle. The utility of cattle is enhanced by numbers, by stalling in warm sheds, by good housing of the human population, and by care against bright lights and open windows.

A. A.

CURRY (D. P.). **A New Anopheline Mosquito, *Anopheles* (*Chagasia*) *bathanus* Dyar, discovered in the Canal Zone.**—*Amer. Jl. Trop. Med.* 1928. May. Vol. 8. No. 3. pp. 243–248. [3 refs.]

This new species differs from both of its nearest congeners *Anopheles* (*Chagasia*) *farjardoi* and *bonneae* in the leg markings, which are thus described: "legs black, speckled with white; femora and tibiae with

white tips; tibiae densely spotted with many small spots; fore and mid tarsi rather coarsely but numerously spotted; first hind tarsal with 5 narrow white rings, the subapical one the broadest; second to fifth white with the apical fourth black and a small black ring close to the base of each, indistinct on the fifth joint." The larva, which is "essentially as in *bonneae*," lives among the tall grasses and sedges of quick-flowing waters, rides high at the surface with the dorsal half of head and thorax and abdomen completely out of water, and, like its above-named congeners, has something of the attitudes and shore-keeping propensities of the Dixa larva. This new species is not one of that unsatisfactory kind which is based on a single mutilated female specimen, but has been seen in such numbers that "the taking and the rearing of specimens in abundance are an easy task."

A. A.

SENEVET (G.) & PRUNNELLE (M.). A propos de la larve de *Anopheles algeriensis* Theobald 1903. [**Larva of** *A. algeriensis*.]—*Arch. Inst. Pasteur d'Algérie.* 1927. Dec. Vol. 5. No. 4. pp. 534–537. With 1 text fig. [2 refs.]

The diagnostic characters of the larva of *Anopheles algeriensis* are set forth in the following table :—

1.	Frontal hairs simple	*A. plumbeus*
	Frontal hairs branched	2
2.	Posterior clypeal hairs branched	3
	Posterior clypeal hairs simple	4
3.	Antero-internal clypeal hairs simple	*A. bifurcatus*
	Antero-internal clypeal hairs branched	*A. elutus*
4.	Antero-internal clypeal hairs with lateral branches	*A. algeriensis*
	Antero-internal clypeal hairs simple	*A. marteri*

A. A.

SENEVET (G.) & PRUNNELLE (M.). Une nouvelle espèce d'anophèle en Algérie, *Anopheles marteri* n.sp. [**New Species of Anopheles from Algeria.**]—*Arch. Inst. Pasteur d'Algérie.* 1927. Dec. Vol. 5. No. 4. pp. 529–533. With 4 text figs. [Pasteur Inst., Algiers.]

A new species, *Anopheles marteri*, is here described as approximate to *A. bifurcatus*, but differing from it and from all other Algerian species in the characters of the male genitalia; the larva also differs in having the posterior clypeal hairs and the antero-internal clypeal hair simple.

A. A.

RAFFAELE (Giulio). Una nuova specie di "Anopheles." (**A New Anopheline Species.**)—*Riv. di Malariologia.* 1928. Jan.–Feb. Vol. 7. No. 1. pp. 11–17. With 6 text figs. [English summary p. 81.] [Experim. Station, Antimalaria Campaign, Rome.]

This new species from Calabria, *Anopheles italicus*, is akin to *superpictus*, *sergenti*, and *hispaniola*, and like *superpictus* breeds in mountain streams. It has distinctive adult and larval characters and its egg is devoid of floats.

A. A.

COVELL (G.). **A Note on the Local Variations and Distribution of** *Anopheles philippinensis* **Ludlow.**—*Indian Jl. Med. Res.* 1928. Apr. Vol. 15. No. 4. pp. 1063–1065. With 1 plate & 1 text fig. [3 refs.] [Central Malaria Bureau, Kasauli.]

The author has examined a considerable collection of *Anopheles philippinensis* individually representing its whole range from the Philippines

westwards to Coorg (in the west of Southern India). Considerable individual variation occurs in the course of the range of the species, but they all merge into one another. [The range of *A. philippinensis* is by no means singular; see this *Bulletin*, Vol. 22, p. 287.)

A. A.

EDWARDS (F. W.). **Mosquito Notes.—VII.**—*Bull. Entom. Res.* 1928. Feb. Vol. 18. Pt. 3. pp. 267–284. With 4 text figs.

Among the items in these notes are diagnoses of four varieties of *Anopheles mauritianus* said to "show a distinct tendency to localization," and a diagnosis of *A. symesi* distinguished as a new species close to *A. mauritianus*.

A. A.

SYMES (C. B.). **Key to the Identification of Common Anophelines of Kenya.** —*Kenya & East African Med. Jl.* 1927. Dec. Vol. 4. No. 9. pp. 281–286. With 12 figs. on plates.

Keys for identification both of adults and of larvae—the latter being particularly well illustrated.

A. A.

DAVIS (Nelson C.). **Notes on the Development of Ovarian Follicles in Argentine Anopheles.**—*Amer. Jl. Hyg.* 1928. May. Vol. 8. No. 3. pp. 467–475. [1 ref.]

According to these observations *Anopheles pseudopunctipennis* does not, as a rule, ripen its eggs after a single feed of blood, although the species of the Nyssorhynchus group may do so under the specially stimulating influence of warm weather. In Anopheles fed only on fruit the ova do not develop beyond stage 2 (of Christophers). The largest eggs of *A. pseudopunctipennis* are barely 6 mm., those of the Nyssorhynchus group are considerably less; in general the length of eggs increases from 15 to 20 per cent. after extrusion.

A. A.

DAVIS (Nelson C.) & SHANNON (Raymond C.). **The Habits of *Anopheles rondoni* in the Argentine Republic.**—*Amer. Jl. Hyg.* 1928. May. Vol. 8. No. 3. pp. 448–456. With 2 text figs. [4 refs.]

The breeding-season of *Anopheles rondoni* in Jujuy (N. Argentina) is at its height probably in March. The species, which according to the authors is not a variety of *A. tarsimaculatus*, is found in houses "in appreciable numbers," but so far has resisted experimental infection with malaria.

A. A.

LA FACE (Lidia). Sulla resistenza delle larve degli anofelini alla salinità. (**On the Resistance of the Larvae of the Italian Anopheles to the Salt Content of Waters.**)—*Riv. di Malariologia.* 1928. Jan.-Feb. Vol. 7. No. 1. pp. 18–30. [16 refs.] [English summary p. 81.] [Experim. Station, Antimalaria Campaign, Rome.]

According to the English summary *Anopheles elutus* in the laboratory is more tolerant of NaCl than *A. maculipennis* and the tolerance of *A. superpictus* is intermediate to the two.

A. A.

SWELLENGREBEL (N. H.) & DE ROOK (H.). Signification du nombre relatif des males d' "*Anopheles maculipennis.*" (**On the Value of the Male Rate of** *Anopheles maculipennis.*)—*Riv. di Malariologia.* 1928. Jan.–Feb. Vol. 7. No. 1. pp. 7–10. With 3 charts. [1 ref.] [English summary p. 80.] [Inst. of Trop. Hyg., Amsterdam.]

The gist of the authors' observations is that the percentage of male Anopheles captured in shelters is no indication of the distance of breeding places unless the captures are made under comparable conditions.

A. A.

MISSIROLI (A.). Alcuni protozoi parassiti dell' "*Anopheles maculipennis.*" (**Protozoan Parasites of** *Anopheles maculipennis.*)—*Riv. di Malariologia.* 1928. Jan.–Feb. Vol. 7. No. 1. pp. 1–3. With 6 figs. on 1 plate. [1 ref.] [English summary p. 80.] [Experim. Station, Antimalaria Campaign, Rome.]

Herein are described and figured, as parasites of *Anopheles maculipennis*, a Crithidia from the gut and Malphigian tubules, a Nosema from the midgut, and, what is more remarkable—since, as the author is aware, the Sarcosporidia are generally supposed to be restricted to the higher vertebrates—a Sarcocystis from the thoracic muscles.

A. A.

COVELL (G.). **A Note on Variations of the Hind Tarsal Markings in** *Anopheles fuliginosus* **Giles and** *Anopheles ramsayi* **Covell.**—*Indian Jl. Med. Res.* 1928. Apr. Vol. 15. No. 4. pp. 1059–1062. [12 refs.] [Central Malaria Bureau, Kasauli, India.]

ADIE in 1903 drew attention to the fact that in Ferozpur in the cold weather (November to April) *Anopheles fuliginosus* appeared in a variable guise, its most conspicuous diversion being in the garniture of the hind legs, the three terminal tarsal segments of which might be completely white. The author confirms this seasonal variability of *A. fuliginosus*, from Saharanpur, and also draws attention to a similar variation in *A. ramsayi*.

A. A.

BOREL (M.). Enquête entomologique et épidémiologique à Can-Tho et Bac-Lieu (Cochinchine). [**Entomological and Epidemiological Enquiry in Cochin-China.**]—*Bull. Soc. Path. Exot.* 1927. Dec. 14. Vol. 20. No. 10. pp. 974–976.

In these discursive remarks Can-Tho, an urban centre in western Cochin-China, is contrasted with a neighbouring rural area, Bac-Lieu. In Can-Tho Anopheles breeding-places have been reduced to a minimum and only a few larvae (*A. vagus*) were seen. In Bac-Lieu Anopheles (*A. vagus*), both larvae and adults, were plentiful, and a few children were observed to have an enlarged spleen.

A. A.

SHANNON (R. C.) & DEL PONTE (E.). Informe de una investigación preliminar sobre los anofeles del rio Alto Paraná, en la Argentina. [**An Account of a Preliminary Investigation into the Anopheles of the River Alto Paraná, Argentine.**]—*Rev. Inst. Bacteriológ.* Buenos Aires. 1927. Mar. Vol. 4. No. 7. pp. 706–723. With 5 text figs.

The prevalent species of Anopheles are *A. albitarsis*, *A. tarsimaculatus* and *A. argyrotarsis*, not the *A. pseudopunctipennis* common in other parts of the Argentine.

H. Harold Scott.

VAN THIEL (P. H.). Maxillenzahnzahl und Flügellänge bei *Anopheles maculipennis*. [**Number of Maxillary Teeth and Length of Wing in** *A. maculipennis*.]—*Acta Leidensia* (*Scholae Med. Tropicae*). 1927. Vol. 2. pp. 198–206. With 2 charts in text. [11 refs.] English summary p. 206.

The substance of this paper is to be found in this *Bulletin*, Vol. 23, p. 712, and Vol. 24, p. 883.

A. A.

CHODUKIN (N. I.). Zur Frage ueber die Atermobiosis bei den Larven einiger turkestanischen Phlebotomi (*Ph. Li, papatasii und Ph. Caucasicus* s. *Sergenti*). [**On the Question of Hibernation by the Larvae of some Turkestan Species of Phlebotomus.**]—*Pensée Méd. d' Usbékistane.* Tashkent. 1927. Oct. Vol. 2. No. 1. German summary p. 128. [In Russian pp. 78–82. 3 refs.]

According to the German summary, Chodukin, in Turkestan, in his studies of the hibernation of *Phlebotomus li*, *P. sergenti*, and *P. papatasii*, observed the phenomenon called by ROUBAUD "heterodynamy," quite independently. In general, his observations agree with those of ROUBAUD (*ante*, p. 279).

He found that the "asthenic" stage of the larva of these species might, without any exposure to cold, be much protracted (to 355 days); that the larva could stand exposure to temperature between —7° C. and —10° C. only a short time; that the usual term of larval "asthenobiosis" (started by a critical lowering of temperature to 11° to 12° C.) ranged between 2 weeks and 2 months; that in one and the same generation of larvae there might occur both "asthenic" larvae [i.e., larvae whose growth is indefinitely protracted] and "active" larvae [i.e., larvae that become full-grown in the course of about 3 weeks]; and that the longevity of the hibernating ("asthenic" or torpid) larva depends upon the timely onset of the critical low temperature—if this fall too late only a small percentage of larvae recover.

A. A.

ROUBAUD (E.). Longue durée de l'asthénobiose pseudo-hivernale chez *Phlebotomus papatasii*; action réactivante de l'athermobiose prolongée. [**Lengthy Pseudo-Hibernal Asthenobyosis in** *P. papatasii*: **Resuscitating Action of Prolonged Hibernation.**]—*Bull. Soc. Path. Exot.* 1928. Feb. 8. Vol. 21. No. 2. pp. 107–108. [1 ref.]

Referring to the state of suspended development that may supervene in the 4th larval stage of *Phlebotomus papatasii*, the author relates an experiment showing that this torpid interval may last for a year. A batch of eggs of this species laid on February 18th, and kept at a temperature of 28° C. gave issue to larvae which, having reached their 4th stage, became torpid and on April 6th were placed in sand and earth in a saturated atmosphere, in a laboratory where the temperature ranged between 14° C. and 22° C. There they were left. One larva (the first) resumed development in November, another in December, others during January, and the last in February.

A. A.

ROUBAUD (E.). L'influence maternelle dans le déterminisme de l'asthénobiose acyclique ; métagonie et réactivants métagoniques. [**Maternal Influence as affecting Delayed Development and Resumption of Development.**]—*C.R. Acad. Sci.* 1928. Apr. 30. Vol. 186. No. 18. pp. 1236–1238.

In batches of eggs of *Stegomyia fasciata* also, according to the author, some of the eggs may contain larvae that exist in a similar state of "asthenobiosis." In the present paper the author surmises that this checked development or "asthenobiosis" is due to an unduly prolonged retention of the individual egg in the ovary ; that eggs that give issue to "active larvae" (i.e., larvae that develop continuously and quickly) are eggs that have ripened quickly in the ovary, and eggs that give issue to "tardy larvae" (i.e., larvae that become torpid and require a special stimulus for resumption of development) are eggs of which the ripening has been slow.

A. A.

CRAIGHEAD (A. C.) & DAS (Sribas). **Report on a Sandfly Survey of Pusa Estate, Bihar.**—*Indian Jl. Med. Res.* 1928. Apr. Vol. 15. No. 4. pp. 861–872. With 1 plan & 1 chart. [9 refs.] [Kala-Azar Commission.]

The Pusa estate, of 1,400 acres in Bihar, is an experimental station, and the headquarters of the Indian Agriculture Department. A staff of 800, Europeans and Indians, is well housed on the estate, of which the sanitation is considered good ; and there is a tidal population of 500 Indian labourers and domestic servants coming in daily from surrounding villages ignorant of the arts of sanitation. Kala azar appears to have been first recorded in 1913 (1 case), to have continued nearly stationary until 1920, and to have greatly increased year by year since 1921 ; but whether the increase is real or is due to different standards of diagnosis is, like the character of the company kept by the good wife of Bath in youth, a question to be left unspoken. A house-to-house search, made and repeated between June 18th and August 1st, and including 180 quarters and buildings on the estate and the bazár and five villages in the environs, disclosed *Phlebotomus papatasii*, *P. minutus* and its variety *niger*, *P. argentipes*, and *P. squamipleuris*—the first three species common everywhere, the last species not so common. Dissections continued from June 20th to August 1st, and including 119 specimens of *argentipes*, brought to light one specimen of this species infected with Leishmania.

A. A.

PATTON (W. S.) & HINDLE (Edward). **The North Chinese Species of the Genus** *Phlebotomus* (**Diptera, Psychodidae**).—*Proc. Roy. Soc.* Ser. B. 1928. Apr. Vol. 102. No. B720. pp. 533–551. With 11 text figs. [7 refs.]

The three novel species from N. China here re-considered were first described in 1926 (see this *Bulletin*, Vol. 24, p. 428) as *P. major chinensis*, *P. sergenti* var. and *P. perturbans* var. Their authors now

give some particulars of their ontogeny and bionomy, and at the same time recharacterize the *perturbans* variety as a new species by name *P. taianensis*.

The eggs and the first and fourth larval stages of each species are severally described and beautifully figured, as also are the spermathecae of *P. major chinensis* and *P. sergenti* var., and the buccal cavity (in comparison with that of *P. perturbans*) and the male terminalia of *P. taianensis*.

All three species appear about the end of May, but whereas *P. major chinensis* is prevalent only during the early part of summer, *P. sergenti* continues abundant in August and may be seen occasionally throughout September, while *P. taianensis* lasts to the middle of September.

P. major chinensis, as observed in the laboratory at room temperature (25°to 30° C.), lays about fifty eggs in one batch. The eggs, which have to be kept moist, generally hatch after 10 or 11 days, the four larval stages occupy altogether 25 to 30 days, and the pupa stage occupies 7 to 10 days, so that the whole life-cycle may be completed in six or seven weeks. All larvae, however (usually 4th stage larvae), that had not pupated by the middle of August passed the winter as larvae and did not pupate until the following February or later. Some of these larvae were found to be able to endure a spell of freezing in the ice-chest. Thus, from eggs of the same batch, and kept under apparently identical conditions, some completed their development in 6 or 7 weeks, while some took nine months. The authors therefore are convinced that in a state of nature this species can only rarely complete its life cycle in one season. The adults are active. The female seems generally to take only one feed of blood and to digest it slowly (in 6 or 7 days) immediately after which she lays her eggs and then dies.

P. sergenti, the commonest of the three species, is easy to keep. The female will feed 3, 4, or even 5 times before laying her eggs, digestion usually being complete on the third day after a full meal. In the laboratory the life-cycle is completed in 7 to 8 weeks. The first stage larva is particularly sluggish. There are two broods in a year. Males of this species were observed paired with females of *P. major chinensis* on five occasions.

P. taianensis seems to have the widest distribution, but is local. Its normal hosts seem to be frogs, toads, lizards, and snakes. It feeds voraciously and digests very quickly, so that it may be got to feed every day or two. The larva is active and hardy, and is able to stand desiccation for a considerable time. The life-cycle is similar to that of the other species, and there seem to be at least two broods in a year.

A. A.

MAGNITSKY (V.) & GUTZEVITCH (A.). **On the Question of the Variation of Some Characters of the Species of the Genus Phlebotomus.**—*Rev. Microbiol. et Epidémiol.* 1928. Jan. Vol. 7. No. 1. English summary pp. 137–138. [In Russian pp. 35–45.]

The authors notice the variability of the accepted specific characters of wing, antenna, and maxillary palp in Phlebotomus, particularly in the males of *P. papatasii* and *perniciosus*. They therefore hail the employment

for taxonomic purposes of characteristic features of the palate and the spermatheca of the female [apparently assuming that these structures do not vary].

A. A.

PERFILIEV (P. P.). Sur l'anatomie des phlébotomes. [**Anatomy of Phlebotomus.**]—*Bull. Soc. Path. Exot.* 1928. Feb. 8 & Mar. 14. Vol. 21. Nos. 2 & 3. pp. 159–171; 254–257. With 20 figs. [14 refs.] [Military Acad. of Med., Leningrad.]

According to the author the novel items brought out in these observations on the anatomy of Phlebotomus are the difference between the salivary glands in the male and female, the presence of a salivary pump in the male, and differences having a taxonomic significance in some structural details of the genital apparatus.

A. A.

PERFILJEW (P.). Beitrage zur Anatomie der Phlebotomus-Larven. [**Anatomy of Phlebotomus Larvae.**]—*Cent. f. Bakt.* I. Abt. Orig. 1928. May 14. Vol. 107. No. 4-5. pp. 296–305. With 11 text figs. [8 refs.] [Military Med. Acad., Leningrad.]

A description of anatomical and microtomical detail of the first-stage larva of Phlebotomus—not suitable for summary.

A. A.

SINTON (J. A.). **Notes on Some Indian Species of the Genus** *Phlebotomus*. **Part XXII. The Female of** *P. newsteadi* **Sinton 1926.**—*Indian Jl. Med. Res.* 1928. Jan. Vol. 15. No. 3. pp. 589–593. With 9 figs. on 1 plate. [3 refs.] [Central Malaria Bureau, Kasauli.]

The species *Phlebotomus newsteadi* was described by this author (*Ind. Journ. Med. Res.*, 1926, Vol. 13) from a male. In the collection containing the male type of the species there have now been found four females which form the basis of the present paper. The main features of the species are the relatively large size, the erect hairs on the abdominal terga, the very long legs, and (in cleared and mounted specimens) the characteristic moniliform spermatheca. The locality given is Kasauli, Punjab, 6,000 ft.

A. A.

PARROT (L.). Sur quelques phlébotomes de la Bokhara. [**Some Phlebotomi from Bokhara.**]—*Rev. Microbiol. et Epidémiol.* 1928. Vol. 7. No. 2. French summary pp. 230–234. [In Russian pp. 183–189. With 5 text figs. 4 refs.] [Pasteur Inst., Algiers.]

Parrot describes from Bokhara *P. minutus* var. *sogdianus* and *P. major* var. *longiductus*, both of which he considers to be new varieties. He also redescribes *P. sergenti* (with which he maintains *P. caucasicus* of Marzinowsky to be synonymous), and *P. lii* of Popow (which he considers to be a variety of *P. sergenti*).

A. A.

POPOW (Peter). Bemerkungen zu: L. Parrot, A propos de *Phlebotomus caucasicus* et de *Phlebotomus sergenti* diese Zeitschrift, 1926, Bd. 30, S. 719. [**Concerning** *P. caucasicus* **and** *P. sergenti*.]—*Arch. f. Schiffs- u. Trop.-Hyg.* 1928. Mar. Vol. 32. No. 3. pp. 148–149.

The author maintains that *Phlebotomus caucasicus* of Marzinowsky is a species distinct from *P. sergenti* of Parrot.

A. A.

JOBLING (B.). **The Structure of the Head and Mouth Parts in *Culicoides pulicaris*, L. (Diptera Nematocera).**—*Bull. Entom. Res.* 1928. Feb. Vol. 18. Pt. 3. pp. 211–236. With 10 text figs. & 4 plates. [21 refs.] [Wellcome Bureau of Scient. Research, London.]

A minute, critical, and finely illustrated anatomical study. Unlike other Orthorraphous blood-sucking flies, the male is provided with mandibles, though they are weak. The severely irritating bite of Culicoides is said to be relieved at once by rubbing with a moistened crystal of sodium carbonate.

A. A.

SHANNON (R. C.) & DEL PONTE (E.). Cuatro notas sobre especies nuevas de Dipteros Nematóceros, Hematófagos o no, de la República Argentina. [**Four Notes on New Species of Diptera found in the Argentine.**]—*Rev. Inst. Bacteriológ.* Buenos Aires. 1927. Mar. Vol. 4. No. 7. pp. 724–736. With 2 figs. [7 refs.]

In the *Rev. del Instituto Bacteriológico*, 1925, Vol. 3, PETROCCHI in a list of the mosquitoes in the Institute collection, included eleven new species without descriptions; in the first of these notes five of them are now described.

In the second note is a description of a new species of Phlebotomus, *P. sordelii*, together with a key to the Argentine species and a bibliography referring to the genus. The third note describes in detail *Bruchomyia pallipes* (Psychodidae), and the fourth a new species of Leptoconops, *L. petrocchiae*.

H. Harold Scott.

WOLLMAN (E.). Le rôle des mouches dans le transport de quelques germes importants pour la pathologie tunisienne. [**The Rôle of Flies in the Carriage of Pathogenic Germs in Tunis.**]—*Arch. Inst. Pasteur de Tunis.* 1927. Dec. Vol. 16. No. 4. pp. 347–364. With 4 text figs. [5 refs.]

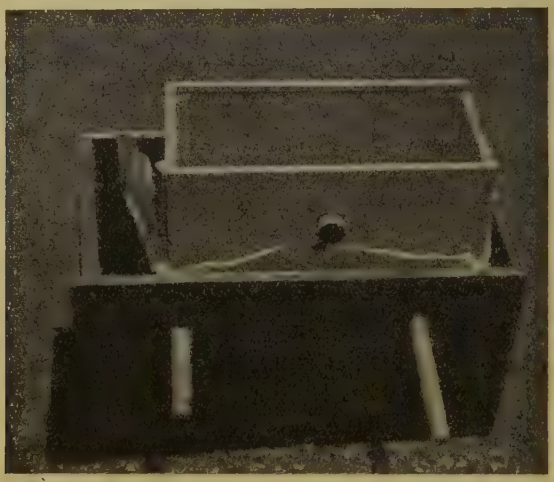
The author begins with some remarks on the antiquity of the observation of the concurrence of morbidity and abundance of flies, and upon the difficulties of acquiring any exact knowledge of this matter through experiment with "wild" flies; he also describes his method of rearing *ab ovo* aseptic flies intended for experimentation. The experiments recorded in this paper give proof that the domestic fly reared aseptically and then exposed for a time to infection, severally, with the bacillus of Weeks (acute conjunctivitis), of Morax-Axenfeld (subacute conjunctivitis), of contagious abortion, and of plague, can remain potentially infective for a certain time afterwards. In the case of Weeks' bacillus the aseptically-reared experimentally-infected flies did not become clean again until 6¾ to 17 hours after infection; in the case of Morax-Axenfeld's bacillus not till 3½ hours after; in the case of *Brucella abortus* not till 48 hours after; and in the case of the plague bacillus not till some time within 24 hours after. The author contrasts the rapidity with which flies freed themselves from the above-specified infections with the long time (12 days) that flies experimentally infected with typhoid and dysentery bacilli retain those infections.

The author thinks that the fly's habit of constantly brushing itself with its tarsal brushes is what frees it from bacteria adhering to the body.

A. A.

BEVAN (Ll. E. W.). **A New Method of Feeding Blood-Sucking Flies.** —*Trans. Roy. Soc. Trop. Med. & Hyg.* 1927. Nov. 25. Vol. 21. No. 3. pp. 219–220. With 2 text figs.

Two boxes are used in this method of feeding blood-sucking flies. One box is large enough to hold a rabbit; the other, smaller, box has (besides the usual guarded opening for introducing and manipulating flies) a glass top and a muslin bottom. Through holes in its sides two



Feeding-box for blood-sucking flies shown in position.
[Reproduced from the *Transactions of Tropical Medicine and Hygiene.*]

wooden rods run across the cavity of the rabbit-box at such a height as to hold down the rabbit with its back projecting between them (the back, of course, being suitably shaved). The wooden rods also support the fly-box, with the back of the rabbit bulging into its muslin floor. The rabbit usually stays quiet and the whole contraption can be left, the flies feeding when they feel inclined.

A. A.

BEATTIE (Mary V. F.). **Observations on the Thermal Death Points of the Blow-Fly at Different Relative Humidities.**—*Bull. Entom. Res.* 1928. May. Vol. 18. Pt. 4. pp. 397–403. With 2 text figs. [5 refs.]

Under the laboratory conditions imposed, a relative humidity of 70 per cent. appeared to be the optimum for blowflies exposed to high temperatures; saturated air and dry air were fatal at lower temperatures than air of 60–80 per cent. humidity.

A. A.

PARMAN (D. C.), BISHOPP (F. C.), LAAKE (E. W.), COOK (F. C.) & ROARK (R. C.). **Chemotropic Tests with the Screw-Worm Fly.**—*U.S. Dept. Agric., Wash., D.C., Dept. Bull. 1472.* 1927. Mar. 32 pp. [5 refs.]

The object of this very elaborate piece of work was to find out some substance, suitable for application to wounds (of domestic animals), to prevent reinfestation by screwworm maggots (*Cochliomyia macellaria*) for at least 48 hours—aside from any necessary larvicidal action. Tests of over 350 repellent substances were made, a measured quantity of each substance being spread upon a standard meat bait exposed in a place where flies were numerous. The repellent value of a substance was decided by the ratio of number of flies visiting the treated bait to number visiting untreated bait. "Of all the materials tested as repellents against the screw-worm fly, certain products obtained from the pine are among the best. These include pine oil, both the destructively and steam distilled, crude turpentine, pine-tar, and pine-tar oil." In consideration of its cheapness, prevalence, innocence, and adhesiveness, the authors consider pine-tar oil the best of all the materials tested by them for protection of wounds of domestic animals against assault by the screw-worm fly. A number of essentials oils are good repellents, as also are the insecticides pyrethrum and derris.

A. A.

MERCIER (L.). Présence de la mouche du ver chevelu des laines australiennes (*Chrysomyia albiceps* Wied.) sur la côte du Calvados. Une hypothèse de travail en vue de sa destruction. [*Chrysomyia albiceps* **found on the Coast of Calvados.**]—*Ann. Parasit. Humaine et Comparée.* 1928. Apr. 1. Vol. 6. No. 2. pp. 200–202. [7 refs.]

The author remarks the wide distribution of *Chrysomyia albiceps* in the warm regions of the Old World and the habits of its larvae (known as "hairy maggots"), about which much has been written. He proposes to control the species by means of the small Staphylinid beetles of the genus *Aleochara*, several species of which are known parasites of dipterous puparia and are easily obtained.

A. A.

MOUTIER (François). Parasitisme occasionnel d'un diptère *Crataerhina pallida* Latreille sur l'homme. [**Occasional Parasitism of** *Crataerhina* **sp. on Man.**]—*Ann. Parasit. Humaine et Comparée.* 1928. Jan. 1. Vol. 6. No. 1. pp. 105–106. With 1 text fig. [3 refs.]

Note of the occurrence of *Crataerhina pallida*, a Hippoboscid fly parasitic on the house-swallow and martin, attached to the head of a young woman who slept in an attic. The flies were traced to some swallow's nests that had fallen down the chimney.

A. A.

NITZULESCU (Virgil). Contributions à l'étude de l'appareil buccal et de la pompe salivaire chez les insectes. [**Mouth Apparatus and Salivary Pump in Insects.**]—*Bull. Soc. Path. Exot.* 1927. Dec. 14. Vol. 20. No. 10. pp. 980–986. With 6 text figs. [4 refs.] [Parasit. Lab., Faculty of Med., Paris.]

Attention is drawn to the bilateral asymmetry of the serrations of the hypopharynx of Phlebotomus. The salivary glands of Simulium

are described and figured. The statement that the floor of the suctorial tube of the females of the orthorraphous Diptera is formed not by the hypopharynx but by the mandibles is emphasized. The suggestion emitted by CORNWALL that the efferent salivary duct of Rhynchota may communicate with the pharynx is strictly contradicted.

A. A.

NITZULESCU (Virgil). Contribution à l'étude de la pompe salivaire des Tabanidés. [**The Salivary Pump of Tabanidae.**]—*Bull. Soc. Path. Exot.* 1927. Nov. 9. Vol. 20. No. 9. pp. 846–851. With 4 text figs. [Parasit. Lab., Faculty of Med., Paris.]

The salivary pump in Tabanidae is here described in detail and is characterized as being in a general way similar to that of Simuliidae, but more posterior to and dissociated from the hypopharynx.

A. A.

KRÖBER (O.). Die amerikanischen Arten der Tabaniden-Subfamilie *Diachlorinae* End. [**The American Species of Tabanidae.**]—*Beihefte z. Arch. f. Schiffs- u. Trop.-Hyg.* 1928. Vol. 32. No. 2. 55 pp. With 26 text figs.

This appears to be a useful piece of work. It contains tables for identification of genera and species, as well as descriptions of individual species and figures of diagnostic features.

A. A.

HARRIS (R. H. T. P.). **Tsetse Fly Investigations in Zululand.**—*Union of S. Africa. Science Bull. No. 62.* 1927. Sept. 26. 19 pp. [3d.]

This is a synopsis of a Report to the Union Government of S. Africa —a report on the bionomy of tsetse-flies in Zululand where *Glossina pallidipes* is said to be " by far the commonest " species. It is to this species that the observations reported relate.

In the laboratory the span of adult life was usually about 100 days, although in one case a petted individual lived 163 days. No female produced more than nine offspring. Although the insect feeds entirely on blood, the author frequently observed it sampling the trunk of a tree with its proboscis. The author thinks that warmth stimulates it to feed.

In the field *G. pallidipes* is an inveterate wanderer and persistent hunter, frequently found in places where there is no evidence of game, and always pursuing its prey by sight. In a bad light or on a cloudy day a suitable host may be overlooked. The author refers at length to his experiments (see this *Bulletin*, Vol. 21, p. 435) showing that a conspicuous dummy, of roughest journeyman make, attracts more tsetses than a naturally inconspicuous zebra. According to the author's experience, where animals are massed together they are likely to be overlooked by this restless wandering *pallidipes* guided entirely by sight, so that there is a continual passing away of these flies from the denser game reserves to areas where animals are scarce. The author, therefore, who believes that the only effective method of controlling the fly is by reducing the game upon which it feeds, is careful to point out that this reduction must " be effected cautiously

under close and highly skilful supervision, and according to a most carefully thought-out plan of operations, or there may be dire and discouraging results."

A. A.

FRANTZEN (Wilhelm). Die geographische Verbreitung und wirtschaftsgeographische Bedeutung der Tsetse-Fliege. [**Distribution and Economic Significance of Tsetse Flies.**] —*Materiaux pour l'Etude des Calamités.* 1928. Jan.–Mar. Vol. 4. No. 16. pp. 293–338. With 1 folding map. [156 refs.]

This is not a very striking compilation. It deals with *Glossina palpalis* and *morsitans*, describing for each species its geographical distribution, its retardative influence on human progress, and something of the attempts at its control. In the case of *palpalis* its pathological significance in the dissemination of human trypanosomiasis is described at some length, and in the case of *morsitans* its economic importance in the spread of nagana among domestic animals.

A. A.

CARRIÓN (Arturo L.). **Preliminary Report on a Rat and Flea Survey of the City of San Juan, Porto Rico.**—*Porto Rico Rev. of Pub. Health & Trop. Med.* 1927. Oct. Vol. 3. No. 4. pp. 131–145. With 7 charts.

In this first survey 360 live rats were killed and examined—287 *decumanus*, 41 *rattus*, and 32 *alexandrinus*. Fleas were found in 53·6 per cent. of them, the total collection of fleas amounting to 2,575. All but 36 of the fleas were identified as *Xenopsylla cheopis*—the 36 exceptions being *Echidnophaga gallinacea* (35) and Ctenocephalus (1). The percentage of rats individually infested with fleas ranged between 100 in July and 30·4 in March. The average number of fleas per rat ranged between 14·41, in May, and 4 in August; the index for the year (stated as "cheopis index") was 7·05.

A. A.

PINTO (Cesar), BARRETO (João de Barros) & FIALHO (Amadeu). Sobre a frequencia das especies de pulgas de ratos, verificadas no Rio de Janeiro. [**Frequency of Species of Rat Fleas at Rio de Janeiro.**] —*Sciencia Med.* 1928. Mar. Vol. 6. No. 3. pp. 110–116. English summary p. 116.

From the middle of July to the middle of December 700 fleas, of which 75 per cent. were from *Mus norvegicus* and 18 per cent. from *Mus rattus*, were identified by the rat-catching service of Rio de Janeiro. Of the fleas 56·28 per cent. were *Xenopsylla cheopis* (26·85 male and 29·43 female); 42·28 per cent. were *X. brasiliensis* (23·0 male and 19·28 female); and the remaining 1·44 per cent. consisted of female specimens of *Leptopsylla musculi*, *Synosternus pallidus*, *Ceratophyllus fasciatus*, *Ctenocephalus felis*, and a male *Pulex irritans*. The average number of fleas per rat for the whole term was 2·4 with a maximum of 6 in September and a minimum of 1·2 in July. *X. brasiliensis* was the most prevalent species in July, August, and October, and *X. cheopis* during the other 3 months.

A. A.

ROUBAUD (E.). Foyer de développement de *Xenopsylla cheopis* à Paris. Observations sur la biologie de cette puce. [**Focus of Development of** *X. cheopis* **in Paris: its Biology.**]—*Bull. Soc. Path. Exot.* 1928. Mar. 14. Vol. 21. No. 3. pp. 227–230. [4 refs.]

After noticing the numerous occurrences of *Xenopsylla cheopis* recorded in England and France, the author goes on to tell of a hot-bed ("un vaste foyer") of this species recently discovered by him in basements and cellars of an establishment in Paris where an installation for central heating kept the underground temperature at 23° to 25° C. The insects were so numerous that in a few days he caught more than 100 in traps. A trap that he finds particularly attractive is a tin cylinder containing the dead body of a mouse packed in buckwheat. The author is able to affirm that this hot-bed is an ancient and permanent focus of development of *Xenopsylla cheopis.*

A. A.

GARNHAM (P. C. C.). **Fleas in Hides and Cotton-Seed.**—*Kenya & East African Med. Jl.* 1927. Dec. Vol. 4. No. 9. pp. 287–290. [1 ref.]

In the course of a year the author examined many bundles of hides and 1,434 bags of cotton-seed being collected for forwarding at Kisumu on the Kavirondo Gulf of Victoria Nyanza, in almost every case making his examinations as the stuff was unloading; and he found that even when rats were absent, unattached fleas were present in considerable number—except among hides that had been packed with naphthol. The species identified were chiefly *Xenopsylla cheopis* and *X. brasiliensis*, the former predominating. As he points out, this is an important observation, since hides and cotton-seed are notoriously dangerous produce in connexion with plague.

A. A.

FIELDING (J. W.). **Observations on Rodents and their Parasites.**—*Jl. & Proc. Roy. Soc. New South Wales.* 1927. Vol. 61. pp. 115–134. [30 refs.]

In 13 months, ending September, 1926, fleas to the number of 536 were obtained from 222 living rats at the Townsville (Australia) Institute of Tropical Medicine; 493 were *Xenopsylla cheopis*, 33 *Ctenocephalus felis*, 8 *Ctenocephalus canis*, 1 *Pulex irritans*, and 1 *Ctenopsylla musculi.*

The following endoparasites were obtained from these and other local rats:—

Coccidia sp. in 10·4 per cent. of 222 rats examined.
Trypanosoma lewisi in 14·0 per cent. of 222 living rats and in 3·2 per cent. of 1,557 dead rats.
Rat leprosy in 0·22 per cent. of 1,779 rats examined.
Hormorhynchus moniliformis in 16·4 per cent. of 222 rats.
Hepaticola hepatica in 6·41 per cent. of 1,779 rats.
Ganguleteracis spumosa in 6·3 per cent. of 222 rats.
Syphacia obvelata in 0·9 per cent. of 222 rats.
Gongylonema sp. in 3·6 per cent. of 222 rats.
Trichuris muris in 11·3 per cent. of 222 rats.
Hymenolepis diminuta in 15·3 per cent. of 222 rats.
Cysticercus fasciolaris in 1·0 per cent. of 1,779 rats.

Doubtful species observed in *Mus norvegicus*, each on one occasion, were *Heligmosoma braziliense* and *Strongyloides* sp.

Neither the plague bacillus (1,779 rats) nor Spirochaetes (222 rats) were found.

A. A.

HENDERSON (J. R.). **A Note on Some External Characters of Larvae of** *Xenopsylla cheopis*.—*Parasitology*. 1928. Apr. Vol. 20. No. 1. pp. 115–118. With 4 text figs. [1 ref.] [Dept. of Zoology, Univ. of Edinburgh.]

This note reports the confirmation of the observations of BACOT and RIDEWOOD on the larvae of fleas (recorded in *Parasitology*, 1914, Vol. 7, pp. 157–175). and adds some particulars of the structure of the antenna, the distribution of the hairs on the thoracic and abdominal segments, and the features and adjuncts of the tenth abdominal segment.

A. A.

INGRAM (A.). **Three New South African** *Xenopsylla* **(Siphonapt.).**—*Bull. Entom. Res.* 1928. May. Vol. 18. Pt. 4. pp. 371–375. With 7 text figs.

Diagnostic features of *Xenopsylla piriei* from nests of Karoo rat and Transvaal gerbille, and *X. hirsuta* and *sulcata* from nests of Cape gerbilles.

A. A.

CHACIN ITRIAGO (L. G.) & BELLO (Carlos J.). Clasificación de las ratas de Caracas. [**Classification of Rats in Caracas.**]—*Gac. Med. de Caracas*. 1927. Nov. 15. Vol. 34. No. 21. pp. 325–327.

Of 2,066 rats caught in Caracas during March–June, 1,980 were *R. norvegicus* and 86 *R. rattus*.

H. Harold Scott.

CHACIN ITRIAGO (L. G.). Clasificación de las pulgas que contienen las ratas de Caracas. [**Classification of the Rat-Fleas in Caracas.**]—*Gac. Med. de Caracas*. 1927. Nov. 15. Vol. 34. No. 21. pp. 327–328. [1 ref.]

Of 1,244 fleas from 1,660 rats caught in Caracas, 1,172 were *Xenopsylla cheopis*; 48 were *X. brasiliensis*; 19 were *Ctenocephalus felis*, and 5 were *Leptopsylla musculi*.

H. Harold Scott.

ROUBAUD (E.) & WEISS (A.). Note sur un hémiptère réduvide chasseur de moustiques et de phlébotomes dans la Tunisie du nord. [**A Reduviid Bug preying on Mosquitoes and Phlebotomus in N. Tunis.**]—*Arch. Inst. Pasteur de Tunis*. 1927. Apr. Vol. 16. No. 1. pp. 81–83. With 1 text fig.

This ravisher of mosquitoes and Phlebotomus, is *Ploiaria* (*Emesodema*) *domestica*, one of those long-legged and highly predacious Emesid bugs that has raptorial front-legs like a Mantis. It is found in and about houses throughout the Mediterranean region and has attracted the authors' attention in houses in Tunis.

A. A.

ROUBAUD (E.). Adaptation spontanée de la punaise des lits (*Cimex lectularius* Merret) en milieu obscuricole, aux rongeurs domestiques. [**Spontaneous Adaptation of the Bed Bug in the Dark to Household Rodents.**]—*Bull. Soc. Path. Exot.* 1928. Mar. 14. Vol. 21. No. 3. pp. 224–226. [3 refs.]

This is a note on a nidus of bedbugs in a Parisian cellar well warmed by an installation for central heating. Hundreds of bugs of all stages, including eggs, were found infesting wooden cages in which white mice were reared in the cellar, the necessary moisture being imparted by dishes of water in which the cages were stood for protection against noxious insects. The bugs were active at all hours of the day, and some of them had wandered from the cages to other parts of the cellar. From the facts that he has seen them thus wandering, and also has received from abroad two young bed-bugs that had been caught on a brown rat, the author concludes—seeing that the cages of white mice were known to be free of this infestation when they were brought to the cellar—that the infestation originated in the cellar and that bed-bugs can adapt themselves to mice and rats and other small deer, and must not be regarded as specific parasites of man.

A. A.

READIO (P. A.). **Studies on the Biology of the Reduviidae of America North of Mexico.**—*Kansas Univ. Sci. Bull.* 1927. Sept. Vol. 17. No. 1. pp. 5–291. With 21 plates. [Numerous refs.] [Dept. of Entomol., Univ. of Kansas, Lawrence, Kansas.]

The Reduviidae are a large family of bugs represented in all regions of the globe, the three tropical and the Australian regions all being much richer in species than the two temperate regions. The family as a whole is predacious, chiefly on other insects; but it includes species that feed on the blood of mammals, and among these are some that have acquired domestic habits and feed on man. Particularly notorious among these last are certain South American species concerned in the transmission of *Trypanosoma cruzi*; others among them are odious because of their painful bites. The present publication deals only with the Reduviidae of temperate North America (Nearctic region); the first 30 pages are devoted to biology and the rest of the work is a systematic account of the species and genera in their several subfamilies, together with bibliography, index, and plates.

A. A.

GLADIN (Sophie). Experimentelle Untersuchung ueber die Wirkung des Käfers *Paederus fuscipes* Curt. (Fam. Staphylinidae) auf das Kaninchenauge. [**Action of *P. fuscipes* on the Rabbit's Eye.**]—*Rev. Microbiol. et Epidémiol.* 1928. Jan. Vol. 7. No. 1. German summary p. 136. [In Russian pp. 18–22. 6 refs.] [Military Med. Academy, Leningrad.]

The little Staphylinid beetles of the widely distributed genus *Paederus* are well known to possess irritant and vesicant qualities. The present paper describes the effects of injecting a suspension of the ground-up beetle into the eye of a rabbit.

A. A.

SAMBON (Louis W.). **The Parasitic Acarians of Animals and the Part they Play in the Causation of the Eruptive Fevers and other Diseases of Man. Preliminary Considerations based upon an Ecological Study of Typhus Fever.**—*Ann. Trop. Med. & Parasit.* 1928. June 12. Vol. 22. No. 1. pp. 67–132. With 19 text figs.

This paper is packed with varied and curious learning and ingenious and suggestive ideas, and is enlivened further by some entertaining personalia. The author takes a biological view of typhus fever, as a species, of very wide geographical range, having many local varieties—such as Rocky Mountain Fever, Japanese River Fever, and the various kinds of typhus or pseudotyphus of Indo-China, Indo-Malaya, and Mexico. He would appear to define the disease as a fever due to a specific Rickettsia having its chief (but not sole) reservoir in small rodents and being transmitted, in the first instance, mainly by the minute acarine parasites of those animals, and particularly by the Trombidiid larvae commonly known as harvest-mites. It is true that in the case of ordinary text-book typhus the disease—as the author claims to have been the first to suggest—is spread among men by the body-louse, but this agency, important though it be, he regards as an "episode" in the larger play of the disease. Such being their importance the author devotes 32 pages to a discursive account of harvest-mites in Europe and America, and harvest-mites in connexion with local forms of typhus in Japan, China, Formosa, Sumatra, Australia, Indo-China, and Mexico. The author takes every opportunity of making an interesting deviation from his course. Thus, from the mention of a Chinese writer of the 16th century, who speaks of a sand-mite that lives in water and by burrowing in the skin of human victims causes a febrile disease, we get on to the Linguatulid larvae occurring subcutaneously in frogs and to the Trombidiid larvae encysted subcutaneously in frogs and other batrachia, and so to endoparasitism of Trombidiid mites.

The eleven pages on mites in other pathogenous aspects include a sketch of the itch-mite in medical history and an enumeration of many well-known acarid parasites of animals by which man also may be attacked. Among these the author mentions the fowl-mites (*Dermanyssus gallinae*) that recently invaded the nurses' quarters at the London Hospital in prodigious numbers and were traced by him to pigeons nesting about the roof. In this connexion the author states that he has suspected for many years that birds and their ectoparasites may be concerned in the natural history of eruptive fevers that affect man and illustrates his argument from an extensive knowledge, both recent and ancient, of the subjects of bird-pox and bird-diphtheria.

The last fifteen pages contain descriptions and figures of new species of Trombidiid larvae. A. A.

WALCH (E. W.). Nederlandsch-Indische Trombiculae en verwante Mijten. (Derde mededeeling.) Soorten uit de Lampongsche districten en de omgeving van Makassar. [**Trombiculae and Related Mites from Dutch East Indies.**]—*Geneesk. Tijdschr. v. Nederl.-Indië.* 1927. Vol. 67. No. 6. pp. 922–932. With 12 figs. on 3 plates. [7 refs.] English summary pp. 932–933. [Med. Lab., Weltevreden.]

This paper deals with the geographical distribution of Trombidiid larvae in the Netherlands East Indies, with particular reference to

that of *Trombicula deliensis* and *T. schueffneri*, the two species regarded as the chief carriers of tsutsugamushi disease locally. Hitherto these two species have been observed only in Deli on the east coast of Sumatra, where alone tsutsugamushi disease has been diagnosed; but *T. deliensis* is now reported as occurring also in South Sumatra, although no information is obtainable as to the existence there of tsutsugamushi disease. The paper also contains a tabulated statement in minute detail of the specific characters of five local species either new to science or new to the local record.

A. A.

PAWLOWSKY (E. N.) & STEIN (A. K.). Ueber die Wirkung des Stiches von *Ornithodoros papillipes* Bir. auf den Menschen. [**Effect upon Man of the Stab of** *Ornithodorus papillipes.*]—*Abhandl. a.d. Gebiet d. Auslandskunde. Hamburg. Univ.* 1927. Vol. 26. (D., Med. & Vet. Vol. 2.) [Festschrift NOCHT.] pp. 401–408. With 5 figs. on 2 plates. [22 refs.]

The author gives some particulars of the occurrence of *Ornithodorus tholozani* in Persia, Turkestan, and Bokhara in circumstances supporting the argument that incriminates this species in the transmission of relapsing fever. In one instance, at Huzar in Bokhara, where two soldiers contracted that disease, marks of tickbite were observed, and a similar observation seems to have been made at Tashkent. The bites of *O. tholozani* and *O. "papillipes,"* which are stated to be painless, are described in great detail, as also are their effects upon the skin (as observed in sections) independent of any possible contamination by the secretion of the coxal glands or from the excreta. Briefly, the puncture of the bite shows as a dark purple or cherry-red spot, surrounded by hyperaemia and minute petechiae; this dark central patch becomes a papilla, which persists for some time. The effects on the skin may be described briefly as an acute superficial inflammation with oedematous infiltration of the reticular tissue of the cutis.

A. A.

GARNHAM (P. C. C.). **Susceptibility of Ornithodorus to Fire.**—*Kenya Med. Jl.* 1926. Dec. Vol. 3. No. 9. pp. 265–266. [1 ref.]

PEARSON & MOUCHET in their book on the Practical Hygiene of Native Compounds in Tropical Africa assert that firing grass huts is useless as a means of destruction of ornithodorus. The author has found this method of value at Kisumu, where a number of camps have become infested, and no other method has proved as satisfactory. An experiment in which ticks were placed in a series of holes at varying depths in such a hut, and the holes filled with earth, showed that all ticks were killed up to a depth of three inches. It may be advisable to deroof the hut and put the grass inside.

A. G. B.

BOREL (M.). Note sur la présence d'*Argas vespertilionis* (Latreille) 1796 au Cambodge. [**Presence of** *A. vespertilionis* **in Cambodia.**]—*Bull. Soc. Path. Exot.* 1928. Apr. 18. Vol. 21. No. 4. p. 328.

In spite of a careful look-out the author, in the course of three years' residence in Cochin China and South Annam, has only once met with an Argasid tick, and that was an *Argas vespertilionis*, at Pnom-Penh.

A. A.

LIMA (Angelo da Costa). Sur le sarcopte producteur de la gale norvégienne. [**The Sarcoptes of Norwegian Itch.**]—*C.R. Soc. Biol.* 1927. Vol. 97. No. 36. pp. 1784–1786.

The author has examined abundant material and now contributes to the interminable discussion as to the zoological status of the parasite of Norwegian itch. He is inclined to agree with those who think it may be a variety of a species of itch-mite proper to some domestic animal—perhaps *Sarcoptes suis* as suggested by FURSTENBERG; but for his own part he has an impression that it may rather be identical with *Sarcoptes canis*.

A. A.

CLEVELAND (L. R.). **Further Observations and Experiments on the Symbiosis between Termites and their Intestinal Protozoa.**—*Biol. Bull.* 1928. Mar. Vol. 54. No. 3. pp. 231–237. [8 refs.] [Dept. of Trop. Med., Harvard Med. School, Boston, Mass.]

Reverting to the subject of depriving termites of their symbiotic intestinal protozoa (see this *Bulletin*, Vol. 22, pp. 835, 836) the author states that this deprivation can be completed in an hour under a pressure of 60 lb. of oxygen—without any immediate ill-effects upon the insects. He now reports that although termites deprived of their protozoa cannot survive indefinitely there are some species in his experiments that lived 107 and even 147 days. Some termites also harbour immense numbers of spirochaetes which are attached to the protozoa—perhaps in some relation of symbiosis. They can be eliminated without damage either to the termites or to the symbiotic protozoa by feeding the termite host on cellulose moistened with 5 per cent. aqueous solution of acid fuchsin.

A. A.

JAFFÉ (R. H.) & WILLIS (D.). **Bartonella Infection in Local Rats.**—*Proc. Soc. Experim. Biol. & Med.* 1928. Jan. Vol. 25. No. 4. pp. 242–244. With 1 text fig. [4 refs.] [Dept. of Path., College of Med., Univ. of Illinois.]

The authors in Illinois find infection with *Bartonella muri* to be much prevalent among the pedigree rats reared in the laboratory and also to exist to some extent among rats supplied by the local dealer. In the laboratory rats at the age of about 4 weeks the organisms were observed to be numerous in the blood before removal of the spleen. In all the adult laboratory rats examined the organisms appeared in the peripheral blood 4 to 5 days after splenectomy; within 2 days the red cells then dropped from 6½ to 2½ millions, and the haemoglobin content to 35 per cent.; some of the animals died, and some recovered. Recovery starts with a sudden and remarkable shower of normoblasts. Of the local dealer's rats only 1 out of 7 became anaemic, and it recovered within 3 weeks. Bartonella is first seen free; later it attaches itself to the surface of the red cell (as many as 30 may adhere to a single red cell); but the authors are not convinced that it enters the red cells.

A. A.

BAYON (H. P.). *Bartonel a muris*; **its Pathogenic Action in the Progressive Anaemia following Rat Splenectomy and its Resemblance to** *B. bacilliformis* **of Carrion's Disease.**—*Jl. Trop. Med. & Hyg.* 1928. Feb. 1. Vol. 31. No. 3. pp. 29–36. [69 refs.]

These speculations on an interesting subject appear to have been suggested by the author's own observations of the results sometimes following splenectomy, in rats.

The author reviews some significant facts in the history of Oroya fever and of verruga peruana, beginning with the discovery in the red blood cells, in cases of Oroya fever, of the micro-organism eventually named *Bartonella bacilliformis*, and ending with NOGUCHI's recent production of verruga-like lesions containing Bartonella by abrading the skin of monkeys inoculated with a pure culture of the micro-organism from a case of Oroya fever; in some of these monkeys transient anaemia was concurrent, and altogether NOGUCHI's experiments corroborate the views of those who have regarded Oroya fever and verruga peruana as different manifestations, provoked under different circumstances, by one and the same pathogenous agent. The author next refers to MAYER's observation—frequently verified, by others including himself—that rats deprived of their spleen frequently develop a pernicious anaemia (often rapidly fatal) associated with the appearance in the blood cells of micro-organisms (*Bart. muris*) akin to *Bart. bacilliformis*; and to the obvious explanation that a latent chronic infection has here become conspicuously animated and illustrated by removal of the spleen. The author's ingenious hypotheses therefore are (1) that Oroya fever may, like this pernicious anaemia of rats, be a Bartonella infection of the blood determined by some intercurrent detriment—as from malaria or from typhoid—to the spleen; (2) that verruga may, as in NOGUCHI's experiment noticed above, be a Bartonella infection of the skin determined by some intercurrent damage—as from an insect bite—to the skin; and (3) that the native reservoir of this Bartonella "virus" responsible in alternative circumstances for a pernicious febrile anaemia or for a warty eruption of the skin, may be, like that of *Bartonella muris*, a small rodent.

A. A.

CANNON (Paul R.), TALIAFERRO (William H.) & DRAGSTEDT (Lester R.). **Anemia following Splenectomy in White Rats.**—*Proc. Soc. Experim. Biol. & Med.* 1928. Feb. Vol. 25. No. 5. pp. 359–361. [3 refs.] [Depts. of Path., Hygiene & Bact., & Surgery, Univ. of Chicago.]

Attention is directed to the fact that in rats the removal of the spleen is not always followed by anaemia. The authors removed the spleen from some of 13 rats recently obtained from the Wistar Institute, and no significant anaemia followed the operation; but in every one of 11 Chicago rats from which they excised the spleen a marked anaemia followed, usually about the fifth day afterwards. They conclude therefore that the effect of splenectomy depends primarily on the source whence the rat is obtained. It is significant that in 2 of the Wistar rats which had been kept in their animal-room

for several months, as also in 2 Wistar rats inoculated with blood from rats of the infected stock, splenectomy was followed by anaemia. The anaemia in all the authors' cases appeared to be identical with LAUDA's infectious anaemia of rats—typified by a fall in the number of red cells to two millions per cmm., a decrease of haemoglobin to 4–5 gm. per 100 cc. of blood, a rise in leucocytes to as high as 70,000, Bartonella inclusions in the red cells, and marked phagocytosis of the red cells. Etherization or other operations also might lead to this anaemia; but in 8 rats subjected to such operations as laparotomy, removal or injury of testicle, removal of adrenals or of frontal lobes of brain no significant anaemia followed, though in 4 of these rats subjected to splenectomy 11 to 13 days after the disabling operation severe anaemia supervened promptly. The authors emphasize this evidence of the dominant influence of the spleen in the defence against latent infections; at the same time they "feel that the demonstration of Bartonella infections among rats in this country necessitates careful elimination of such infected animals from experiments involving a study of nutrition, and particularly from all experiments in which splenectomized animals are used."

A. A.

LAUDA (E.) & MARCUS (F.). Zur Frage der Ratten-Bartonellen [**Bartonella of Rats.**]—*Cent. f. Bakt.* I. Abt. Orig. 1928. Apr. 18. Vol. 107. No. 1–3. pp. 104–114. [18 refs.]

The authors return to Lauda's study of the sudden and severe haemolytic anaemia that in a large percentage of rats follows the removal of the spleen. (Lauda supposed the ultimate cause of this anaemia to be an invisible virus.) Here they consider the theory of MAYER, BORCHARDT, and KIKUTH (see this *Bulletin*, Vol. 24, p. 831) who suppose that certain dumbbell-shaped inclusions in the red blood cells of such despleened rats—inclusions called *Bartonella muris ratti* by MAYER—are the causative parasites of the anaemia. The authors refer to 61 despleened rats, of which a careful and in most cases a daily blood-examination was made, and in 4 of them no Bartonella inclusions could be found in the course of many weeks. Again they give abstracts of observations of four despleened rats showing that Bartonella may appear and disappear and then re-appear, and that such re-appearances are not always associated with anaemia. They summarize the results of several long series of experiments showing their general failure to observe any sequence of Bartonella inclusions in spleen-intact rats suffering haemolytic anaemia artificially induced by injurious injections. (1) In the first of these series of experiments 16 rats received injections of a rat haemolysin obtained from rabbits: in most of them degenerative changes and great decrease in the red cells occurred, but in not one case were undoubted Bartonella bodies found in the circulating blood; in one instance a single dumbbell-like body was seen, but after death (from severe haemolytic anaemia) no other indubitable bodies were found in this case. (2) Seven rats received subcutaneous injections of toluylendiamin; a great reduction in the number of red cells occurred, but in only one case were Bartonella bodies found. (3) Five rats were treated with pyridin; in only one case were well developed Bartonella bodies observed. (4) Five rats injected with phenylhydrazin; the following day isolated intracellular bodies of suspicious appearance

were visible, but thereafter in only one case were clusters of Bartonella found and in isolated red cells. (5) Fifteen rats (14 of which had previously been infected with trypanosomes) were injected with germanin ; in only one instance were undoubted forms of Bartonella detected. (6) Three rats treated with saponin were all negative.

A. A.

SCHILLING (Viktor) & SAN MARTIN (Antonio). Ueber die Bartonellen-Anämie der Ratten. Die Kultur der Erreger, Immunität und Erkrankung milzhaltiger Ratten. [**Bartonella Anaemia of Rats.**] —*Klin. Woch.* 1928. June 17. Vol. 7. No. 25. pp. 1167–1169. [First Med. Clinic ("Charité" Hosp.), Univ., Berlin.]

The experiments tabulated in this paper are held to confirm the provocative element in *Bartonella muris ratti* infection. The following are the conclusions. Of 13 rats from which the spleen had been removed 11 were found to be infected and 2 not infected ; and the 2 negative rats were found to be equally immune when inoculated with Bartonella blood. Of 7 rats with spleen intact and all apparently negative 3 remained negative and 1 was doubtfully positive after inoculation with Bartonella blood, and 1 remained negative and 2 became doubtfully or certainly positive after inoculation with Bartonella culture. Of 6 rats recovered after splenectomy 5 were found positive when re-inoculated with Bartonella blood and 1 was positive when re-inoculated with Bartonella culture. Morphologically and clinically *Bartonella muris ratti* is very much different from *Bart. bacilliformis* of Oroya fever and from the "Erythrokonten"* of pernicious anaemia.

A. A.

REGENDANZ (P.) & KIKUTH (W.). Sur la *Bartonella muris ratti* (Mayer). [*Bartonella muris ratti.*]—*C.R. Soc. Biol.* 1928. May 25. Vol. 98. No. 17. pp. 1578–1579.

PINTO, FARIA, and O. CRUZ, Jr., found that rats at Rio de Janeiro exhibited infection with *Bartonella muris ratti* after removal of the spleen ; but in the present authors' experiments no evidence of Bartonella appeared in 5 Rio de Janeiro rats, or in an exceptional 3 of 25 wild rats from the suburbs of Manguinhos, subsequent to splenectomy. These results show that in South America, as in some other parts of the world, latent infection with *Bartonella muris ratti* is not universally predicable for the rat. That *Bart. muris ratti* and *Bart. bacilliformis* are distinct is shown in the following series of experiments : 2 despleeniated white rats inoculated with *Bart. bacilliformis* (about 1 cc. of a culture intravenis) did not develop infection ; several weeks afterwards the same two rats, along with a third merely despleeniated white rat and a control rat, were inoculated with blood from a rat infected with *Bart. muris ratti* with the result that all three white rats became infected and died of haemolytic anaemia, and the control rat was unaffected.

A. A.

*The Erythrokonten described by Dr. V. Schilling in *Klin. Woch.* (April 22. No. 17. p. 785) are Bartonella-like bodies which he has found in the red cells in 39 cases of pernicious anaemia.

SORGE (G.). Sulle anemie da " Bartonella " dei ratti smilzati. [**" Bartonella " Anaemia in Splenectomized Rats.**]—*Biochim. e Terap. Sperim.* 1928. May 31. Vol. 15. No. 5. pp. 161–179. [37 refs.]

LAUDA attributed the often fatal haemolytic anaemia observed by Mayer to follow splenectomy in rats to a toxic or infective factor, and not to the splenectomy *per se*. MAYER, using Viennese rats, had found that a few days after splenectomy, or even ligature of the splenic vessels, haemolytic anaemia occurred simultaneously with the appearance of bacillary and cocci bodies (Bartonella) in the red cells, and he believed that the rats were infected with *Bartonella muris ratti*, which became manifest as a result of splenectomy (Mayer 1921).

The author repeated these experiments with Viennese and Catanese rats and found that the former reacted to splenectomy as above, but not the latter, and inferred that the former were infected with Bartonella, the latter not. Catanese rats were then fed with the liver of infected rats and others with the liver of splenectomized rats which had shown the above changes, but the results were negative. It was, however, a simple matter to infect the Catanese rats by subcutaneous, intraperitoneal, or intravenous inoculation of fresh aqueous extract of the liver of an infective splenectomized rat. The period of incubation, dating from the moment of splenectomy in infected animals, or of inoculation into the non-infected previously splenectomized, varied from a few hours to eight days. In the majority the " parasites " appeared in the blood in three days and the anaemia was pronounced in 6 days. Attempts to transfer the virus to monkeys, dogs, rabbits, guineapigs, and birds have been unsuccessful whether the animals had been splenectomized or not, but in the cases of splenectomized hamsters and mice intracardiac injection of blood rich in parasites yielded positive results, though the disease produced was less severe than in the rat and recovery took place.

Applying these findings to Oroya fever. The disease is essentially a severe progressive haemolytic anaemia ; the symptoms and pathological changes closely resemble those of the " infective anaemia of the splenectomized rats." By severe involvement of the spleen in the one case, or removal of it in the other, a blocking of the reticulo-endothelial system occurs, the spleen as an organ of defence is eliminated, and the infection spreads.

Other examples given in support of this are the graver effects of experimental infection with trypanosomes in splenectomized rats as compared with controls, and the observation of KIKUTH of a Cercopitheque imported from Africa whose blood was systematically examined for two months and the animal then splenectomized. Ten days later a severe piroplasma infection arose which terminated fatally. Transmission to normal monkeys produced no demonstrable infection until splenectomy was performed, ZIEMANN is cited by KIKUTH (*Arch. f. Schiffs- u. Tropen-Hyg.* Bd. 31. 1927, p. 37) as having observed the same with *Piroplasma canis*.

H. Harold Scott.

REVIEWS AND NOTICES.

PETTIT (Auguste) [Professeur à l'Institut Pasteur, Membre de l'Académie de Médecine.] Contribution à l'étude des spirochétidés. Tome I. (I. Morphologie, Physiologie & Chimiothérapie des Spirochétidés. II. Genres & Espèces de Spirochétidés. III. *Spirochaeta icterohemorragiae.*) [**Contribution to the Study of Spirochaetes.**]—pp. iv+119, with 47 figs.+265, with 69 figs.+267, with 27 figs. & 14 plates (2 coloured). 1928. Vanves (Seine): Published by the Author, 70 rue Jullien. [80 francs.]

The number of publications dealing with spirochaetes has increased so rapidly in recent years that all students of this group will welcome the attempt made by Professor Pettit to collect together our present knowledge. The work is essentially a compilation rather than a critical revision, for the author considers that the present state of our knowledge is too imperfect for the preparation of a complete monograph of the group. Consequently the reader is presented with diverse points of view concerning classification, nomenclature, multiplication, life history, etc., and left to form his own conclusions. In some respects it is rather unfortunate that the distinguished author has not seen fit to give a more definite opinion on some of these questions, for amidst a number of conflicting views it is difficult for a reader without a very special knowledge of the subject to appraise the value of evidence supplied to him with such impartiality. For example, the chapter dealing with the method of division in spirochaetes might convey the impression that these organisms multiply by longitudinal, as well as transverse, division, a view which has been generally abandoned for many years. Moreover, different names are employed for the same organism; *e.g.*, the fowl spirochaete is referred to indiscriminately as *Sp. gallinarum* and *Sp. marchouxi*.

The complete work will consist of six parts under the following headings:

1. Morphology, physiology and chemotherapy.
2. Genera and species.
3. *Spirochaeta ichterohaemorrhagiae.*
4. Technique.
5. Bibliography.
6. Index.

The present volume contains the first three parts, each of which is complete in itself.

Part 1, comprising 119 pages, deals with general questions and a few of the chapters have been written by other workers. Thus DELAMARE contributes an account of his method of measuring the length and height of the curvatures of spirochaetes as an aid to the morphological identification of these organisms. The type of spiral is described by COMANDON, who finds that all the spirochaetes examined by him have a right handed spiral, like that of an ordinary corkscrew, and the same author collaborates in the chapter dealing with motility. FOURNEAU contributes an interesting account of chemotherapy in spirochaetal infections.

Part 2, of 265 pages, contains a description of the hitherto described genera and species of spirochaetes, both free living and parasitic. The author, for the most part, retains the nomenclature used in the original descriptions, and commences with an account of the free living spirochaetes, special attention being devoted to the forms resembling *Leptospira icterohaemorrhagiae*. This is followed by an account of those living either as commensals or parasites, the organisms being arranged with relation to the animals in which they have been observed. Many of the descriptions are accompanied by line drawings of the organisms and information concerning their occurrence and biology.

Part 3, of 267 pages, deals entirely with *Spirochaeta icterohaemorrhagiae* and contains a detailed account of the subject based largely on the classical monograph by MARTIN and PETTIT, which is brought up to date.

In a compilation of this nature it is unavoidable that a few inaccuracies should have crept in, but these do not seriously detract from the value of the book, which will be of very great assistance in future studies of this group, and the author is to be congratulated on the manner in which a work representing such an amount of labour has been accomplished.

E. Hindle.

HERMANS (E. H.). [Hoofd v.d. Dermatol. afd. v.h. Ziekenhuis voor Scheeps- en Tropische Ziekten te Rotterdam.]—**Framboesia Tropica.**—191 pp. With 37 figs. on 10 plates. 1928. H. J. Paris, Amsterdam. [7s. 6d.]

This monograph is a useful study of the problem of yaws. The literature on the subject is treated in all its aspects and special reference is given to the views of Dutch observers. The discussion of the relationship between yaws and syphilis is of great interest. Although both conditions are akin to each other and although we are unable with our present means to distinguish with certainty the *Treponema pallidum* from the *Tr. pertenue*, the author thinks that the history, the geographical distribution, the clinical picture and other factors militate against the views of those authors who regard yaws as a variety of syphilis. Histologically the author sees a marked difference between yaws and syphilis, since yaws commences as a rule in the superficial layers of epidermis and the bloodvessels in the papillae show very slight changes, while in syphilis there is much thickening of the papillae and the blood vessels are typically affected. In yaws the spirochaetes can be found mainly in the epidermis especially amongst the prickle cells of the malpighian layer. In syphilis they are most numerous in the deepest part of the epidermis and in the corium. The author finds that besides the typical plantar and palmar keratosis, there is extensive scar formation, which sometimes interferes with the mobility of large articulations (especially of the elbow) and is characteristic of yaws. He also ascribes to yaws a contracture of the fourth and fifth fingers, which is very common on the Moluccas and formed a connecting link between yaws and rhinopharyngitis mutilans (gangosa) on the one hand and between yaws and goundou on the other.

Diseases of bones as a result of yaws are much more common in the Dutch East Indies than syphilitic bony changes in Europe, while affections of the internal organs, meninges and brain are rarely met with as sequelae of yaws. Locomotor ataxia, G.P.I. and aneurysms never occur in connexion with this disease.

While discussing the treatment of yaws, the author gives a warning against the indiscriminate use of salvarsan, although he is quite aware of the excellent momentary results of this therapy. (In the Dutch East Indies, where the native population is systematically treated with neosalvarsan, more than 1½ millions of injections have been given since 1919.) He points out that in syphilis as well as in yaws, in those cases where the secondary skin eruption is more intense, the late symptoms are slight and he suggests that, owing to the suppression of the secondary yaws by the action of salvarsan, this disease may in future assume a different and possibly a more severe course.

He therefore advises the injection of neosalvarsan only after the complete development of the secondary yaws and then only in combination with potassium iodide, mercury and bismuth.

H. Lwow

AUSTEN (E. E.) [Major, D.S.O., Keeper, Dept. of Entom.] **The House-Fly: its Life-History, Importance as a Disease Carrier and Practical Measures for its Suppression.** Third Edition. British Museum (Natural History). Economic Series. No. 1A. 71 pp. With 13 figs. 1928. London: Printed by Order of the Trustees of the British Museum. [1s.]

Amendments in the new edition of this solicitously careful work are rather of the kind that if the house-fly were a thing of beautiful and dignified associations, might be described as painting the lily or adding another hue unto the rainbow. One of the most conspicuous additions is a reproduction of a photograph of the insect's eggs, greatly enlarged—this at least confirming the ancient truth that there is nought so vile as to be without some small claim to grace. In the text we notice some minor touches that add precision to the impeachment of the insect before the tribunal of pathology, some additions to methods of forestalling maggots in dumps of town-refuse, and a description of a comparatively recent American method of destroying adult flies in large commercial and industrial buildings by means of calcium cyanide, the powder being distributed at night, when the creatures at last are at rest, at the rate of half an ounce per 1,000 c. ft. of space. It is to be noticed also that the author's peroration is now charged with a burden more of indignation than of sorrow, at the thought of the "pastrycook's wares in shops" still "freely exposed to contamination by house-flies" in these islands—just as they were in the days of Chaucer's gentle Roger.

A. Alcock.

YAWS AND SYPHILIS (CORRESPONDENCE).

TANGANYIKA TERRITORY: Annual Medical & Sanitary Report for Year ending 31st December 1926. pp. 109–110. **Extract from the Annual Report on Yaws and Syphilis.**

"On page 658 of the August number of the *Tropical Diseases Bulletin* [1928] there is a mild criticism of an account of some cases treated with Bismuth sodium potassium tartrate and published under my name in the Annual Medical Report for Tanganyika Territory 1926.

"The diagnoses, treatment, conclusions and written account were entirely the work of an Indian sub-assistant surgeon with medical qualifications, and I did not see the cases, being engaged elsewhere on sleeping sickness work. By some oversight or clerical error it was published under my name. On seeing the printed Annual Medical Report, I disclaimed authorship, but it was of course too late to remedy the error. It is a small matter, but no one wishes to have the work of others, whether good or bad, published as a scientific contribution of his own."

J. F. CORSON,
Asst. Bacteriologist, Tanganyika Territory.

21 *August*, 1928.

ERRATUM.

Vol. 25. No. 7. p. 577. KIKUTH & TROPP'S paper on Bird Malaria Studies: the dosage of adrenalin used to induce artificial relapse in birds was 0·06 *mgm.* not 0·06 gm. as printed in line 7 of summary.